

17.50

THE CP/M USER'S JOURNAL

\$3.95

Microsystems

Volume 4/Number 11

November 1983

**Super
16-bit
micros—
architecture
and real
implementations**

Some Super 16-bit Micros

Bill Wong compares the architectures of the 80286, 68000 and 16032, and highlights their most important features.

Hardware Reviews

Andrew Bender reviews the CompuPro System 8/16, Model 86/87, which gets its speed from the 16-bit 8086 and 8087 math coprocessor.

David Hardy and Kenneth Jackson review a new S-100 board from CompuPro: the CPU-68K processor, supplied with CP/M-68K.

Hardy and Jackson also review a dual-processor desktop computer from Zenith: the Z-100, which uses 8085/8088 CPUs and has S-100 expansion slots.

Software Reviews

David Dupuy reviews the \$29 Nevada Fortran from Ellis Associates. Robert Minnis contributes some notes on Fortran-80 from Microsoft.

Other Feature Articles

Andrew Bender shows how to break the 64K barrier on a veteran S-100 computer, using a simple extended address memory manager.

Bill Wong concludes his Introduction to Local Area Networks, of which the first part appeared last month.



**MACROTECH INTRODUCES ADIT
THE I/O WITH A MIND OF ITS OWN.**

Take a load off your CPU.

Our new ADIT DMA I/O boards, used in conjunction with our complete line of dynamic memory boards, can offer you extremely efficient expansion of your S-100 system.

A Z80B microprocessor provides on-board intelligence. ADIT features up to 16 channels per slot, full software compatibility, multi-mode operations and will make all your user ports good to the last byte.

Write or phone us for complete information about how ADIT 16-channel intelligent DMA I/O boards and Macrotech modular memory boards will increase the speed and capabilities of your system.

*The Macrotech family of modular
products includes:*

MAX 256

MAX 512

MAX 768

MAX-M

MAX 384

MAX 640

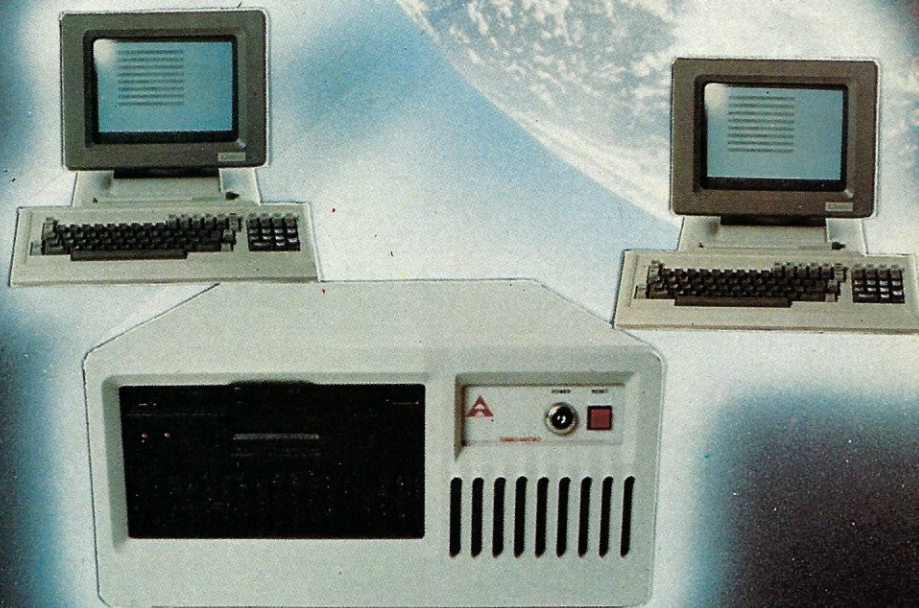
MAX 896

128ST

and

ADIT. The intelligent solution to S-100 I/O

TURBO FORCE™



- ★ MULTI-USER HARD DISC SYSTEM
- ★ TURBO-DOS OPERATING SYSTEM
- ★ UP TO 4 INDEPENDENT USERS
- ★ S-100 BUS ARCHITECTURE - 6 SLOTS
- ★ 8-BIT AND/OR 16 BIT PROCESSOR BOARDS

The "Turbo-Micro" is a revolutionary new business system designed for single or multi-user, multi-processor networking capabilities for fast response time. The "Turbo-Micro" is an attractive desktop computer with modular designs for fast and

easy maintenance, yet it is rugged and well packaged for safe shipping and handling. It represents a state-of-the-art advancement with reliable components and disk drives. It is a powerful, yet compact system, 16" W x 7½" H x 22¼" D.

PACKAGED DEALER PRICE \$4995.

PRICE INCLUDES:

- Complete desktop system with 110/220V power
- Master processor board — Z80B 6MHz, 64K. Byte memory, 2 serial/2 parallel ports, DMA
- Two slave processor boards, Z80B 6MHz, 64K. Byte memory, 4 serial/2 parallel ports, per board
- 25M. Byte winchester hard disk, 5¼" drive
- Floppy disk drive DS/DD, 1.6M. Byte, 8" drive
- Turbo-Dos* multi-user operating system with print spooling capabilities
- 100% CP/M* compatibility
- Complete manuals with schematics and diagnostics

**Please call today or visit us,
to reserve one for you, and
MAY THE TURBO FORCE BE WITH YOU!**

OVERSEAS INQUIRIES ARE INVITED.

- * Turbo-Micro is a trademark of Advanced Computer Technology, Inc.
- * CP/M is a trademark of Digital Research Corporation
- * Turbo-Dos is a trademark of Software 2000, Inc.

Printed in USA

©1983 ACT Inc.

SYSTEM OPTIONS:

- 16-bit processor, Intel 186 CPU with 128K. Byte or 256K. Byte memory
- Master/Slave CPU upgrade to 128K. Byte memory
- Battery back-up for up to 10 minutes of operation
- System upgradable to the powerful stand-alone cabinet for future expansion
- CP/M 2.2* or CP/M 3.0* operating system
- Complete library of application programs, general business accounting, CPA, medical, dental, pharmacy, construction, manufacturing, POS, PTY management and many others
- Terminals and printers are optional

CIRCLE 8 ON READER SERVICE CARD



ADVANCED COMPUTER TECHNOLOGY, INC.

**5575 MAGNATRON BLVD., SUITE D
SAN DIEGO, CA 92111 (619) 571-2746**

Whatever They Are

All MuSYS systems utilize TurboDOS, the Industry

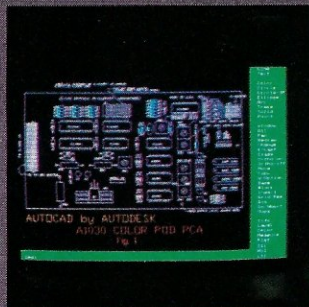
NET/work is a trademark of MuSYS Corporation. TurboDOS is a trademark of Software 2000, Inc. CP/M is a trademark of Digital Research, Inc. Ethernet is a trademark of Xerox Corporation.

GDL's A-1000™

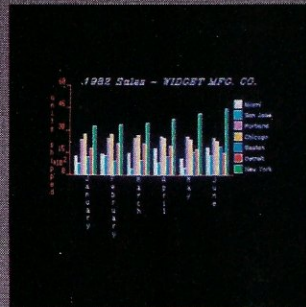
Why Pay More For Less?



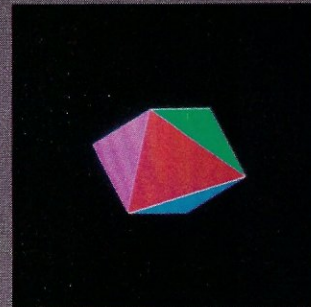
N.M.R. Brain Scan
J. Libove, Dual Systems



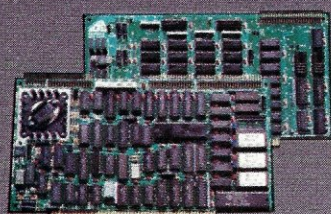
Autocad by Autodesk
R. H. Hymes, GDL



Supercalc Data Graph
Pacific Basin Graphics

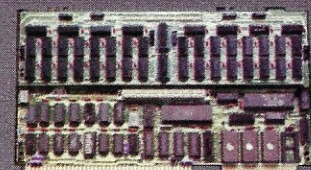


Octahedron With Hidden Surfaces Removed
Dr. C.L. Morgan,
Calif. S.U. Hayward



S100/696 A1000

- On-board 16 Bit Processor
- High-level Commands
- S100/696 or Multibus
- High Resolution
- Multiple Display Formats
- Simple Interface
- Extensive Software Support
- Download Capability
- Up to 16 out of 4096 Colors
- On-Board Self-Test



Multibus A1000

Graphics Development Laboratories

has finally made high performance color graphics affordable. These S100/696 and Multibus compatible boards are currently at work in such diverse areas as Medicine, CAD, Education, Science, and Stock Market Analysis. And it's easy to see why, with their on-board 16-bit 8088 processor and extensive firmware, they act as intelligent graphics sub-systems, relieving the host of time intensive graphics processing, thus maximizing system throughput. Display memory is completely isolated from the host's bus and all communications occur through I/O ports. This simple interface and the high level commands allow for quick integration into any S100 or Multibus system.

Software Support

The A-1000 command set not only includes pixel and vector draws but also **Polygon Area Fills, 2D rotation, scaling, clipping, dither fills, terminal emulate mode, stroke and raster character sets, circles, windowing and viewporting.** A Microsoft compatible subroutine library and C driver are included with every A-1000, at no extra cost. A **PLOT 10** driver and **GIOS** driver for **GSX** are available.

The A-1000 is supported by extensive third party software including:

AUTOCAD by AUTODESK

A 2D drafting package for use by Architects, Engineers or anyone requiring high quality diagrams.

PBG100

Business software that graphs data from **Supercalc** and **DBASE II** files and keyboard input. Also **Hershey** character sets are available.

PBG100 Library

A **Calcomp** compatible subroutine library.

The Analyst

Stock market analysis.

OEM's, Dealers and Systems Integrators

GDL offers generous discounts to OEM's starting in small quantities. So whether you are a small systems integrator or large OEM, you will find our pricing attractive.

To find out more about the A-1000, call or write. **Dealer inquiries welcome.**

A-1000 is the trademark of Graphics Development Laboratories, Analyst is the trademark of Kates Computers, PBG100 is the trademark of Pacific Basin Graphics, Graf-talk is the trademark of The Redding Group, UGRAF is the trademark of Transparent Data Systems, Supercalc is the trademark of Sorcim Inc, DBASE II is the trademark of Ashton Tate Inc, GSX is a trademark of Digital Research Inc. Autocad is a trademark of Autodesk Inc.

REPRESENTATIVES

MARTIAN TECHNOLOGIES

8348 Center Dr. Suite F
La Mesa, Ca. 92041
(619) 464-2924

MOMS COMPUTING

Bldg. 105-5, Fort Cronkite
Sausalito, Ca. 94965
(415) 331-2043

EDWARDS ENGINEERING

1288 E. Mission Blvd.
Pomona, Ca. 91766
(714) 629-4349

MARTIAN TECHNOLOGIES

MOMS COMPUTING

TRACK COMPUTER CENTER

2100 Broadway
Oakland, Ca. 94612
(415) 444-8725

W. W. COMPONENT SUPPLY

1771 Junction Ave.
San Jose, Ca. 95112
(408) 295-7171

MENDOCINO MICROCOMPUTERS INC.

32191 Albion Ridge Rd
Albion, Ca. 95410
(707) 937-5001

TOTAL ACCESS

2054 University Ave.
Berkeley, Ca. 94709
(415) 540-8066

TRACK COMPUTER CENTER

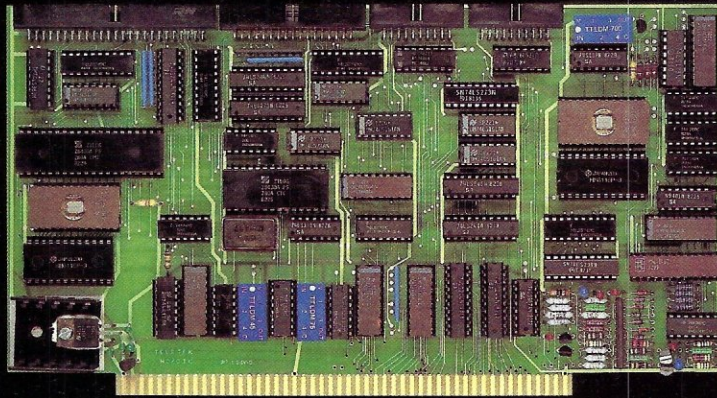
1514 University Ave.
Berkeley, Ca. 94703
(415) 845-6366

DEALERS



GRAPHICS DEVELOPMENT LABORATORIES
2832 Ninth St., Berkeley Ca. 94710
(415) 644-3551

Bored Waiting? Here's The Board You've Been Waiting For.



A hard disk and cartridge tape controller together on one board? Magic? Not really. It's Teletek's HD/CTC. The hard disk and cartridge tape drive controller provide the support necessary to interface both rigid-disk drives and a cartridge tape deck to the S-100 bus.

- A Z-80A CPU (optionally Z-80B) providing intelligent control of the rigid-disk and cartridge tape drives.
- Support of 5 1/4" rigid-disk drives with transfer rates of

5 megabits per second. Minor changes of the on-board components allow the support of other drive types/sizes and transfer rates up to 15 megabits per second. (Interface to disk drive is defined by software/firmware on-board.)

- Controller communications with the host processor via 2K FIFO at any speed desirable (limited only by RAM access time) for a data block transfer. Thus the controller does not

constrain the host processor in any manner.

- Two 28-pin sockets allowing the use of up to 16K bytes of on-board EPROM and up to 8K bytes of on-board RAM.
- Individual software reset capability.
- Conforms to the proposed IEEE-696 S-100 standard.
- Controller can accommodate two rigid-disk drives and one cartridge tape drive. Expansion is made possible with an external card.

Teletek's HD/CTC Offers A Hard Disk
Controller, Plus Cartridge Tape Controller,
All On One Board.

TELETEK

9767F Business Park Drive Sacramento, CA 95827 (916) 361-1777 Telex #4991834 Answer back-Teletek

© Teletek 1983

CIRCLE 220 ON READER SERVICE CARD

Contents

Microsystems

Volume 4/Number 11
November 1983

Microsystems Reviews: The New 16-Bit Super Microcomputers by William G. Wong The Intel 80286, Motorola 68000, and National 16032 offer minicomputer power in a single chip _____	36
Microsystems Reviews: The CompuPro CPU-68K by Dave Hardy and Ken Jackson A machine capable of multiuser, multitasking applications far in advance of those available in the 8-bit world _____	62
The CompuPro System 8/16 Model 86/87 Computer by Andrew Bender ¹ Rock solid hardware with software to boot forms the foundation of this microprocessor _____	64
An Introduction to Local Area Networks: Part II by William G. Wong Setting up a computer network: the final article in a 2-part series _____	70
Zenith Low-Profile Z-100 Computer System by Dave Hardy and Ken Jackson A complete and expandable system that offers the advantages of both 8-bit and 16-bit processing _____	100
Extended Memory Management for Older S-100 Computers by Andrew Bender Build a multibank system that can run CP/M Plus using your older S-100 memory boards _____	106
Nevada Fortran from Ellis Computing by David L. Dupuy Ellis Computing offers capable Fortran with powerful features at a remarkable price _____	114
Some Notes on Microsoft Fortran-80 by Robert S. Minnis An implementation that provides a useful and productive system in Fortran _____	118

DEPARTMENTS

Editor's Page _____	8
News and Views _____	13
The S-100 Bus _____	18
The UNIX File _____	24
In the Public Domain _____	30
Letters to the Editor _____	32
Software Directory _____	122
New Products _____	130

The best of UNIX™ and more for CP/M™ **CLIP/\$49.95**

No risk. 15 day, money back guarantee*

CLIP runs as a standard CP/M 2.2 program replacing the console command processor with a powerful UNIX-like shell. CLIP, optimized for the Z80, takes only 5.2K of additional memory when running your applications programs.

• Over 50 resident commands

• Editing keys

Single keystroke commands allow you to edit and recall your last 10 commands —just like a word processor! These editing keys may be used within most existing programs, too.

• UNIX-like enhancements

CLIP brings the most powerful UNIX features, namely, I/O redirection and pipes, to CP/M.

• Design your own commands

CLIP is also a powerful "macro" programming language replacing SUBMIT with:

Conditional command execution
Argument and switch parsing
Command tracing
File I/O (OPEN, GET, PUT, CLOSE)
Extensive string manipulations

• Built-in calculator

This binary, octal, decimal, and hex calculator can pass its results to programs, macros, or 10 memories.

• Built-in universal text editor

• And much more!

On-line HELP, file searching, user defined prompt, and multiple commands per line.

Software Tools Package \$25

A set of fourteen software tools, inspired by UNIX, complement and enhance CLIP. These tools contain: a sorter, binary file editor, resynchronizing file comparer, pattern matcher, word extractor, and more!

File Encryptor \$25

This program will keep letters, data, programs, or any CP/M file secure.

CLIP, Tools and Encryptor \$99.95

Experience more productivity and control of CP/M today! With our money back guarantee, you have nothing to lose!

Visa/MC/Check/MO/PO accepted
Add \$3.50 shipping, AZ: 7% tax

Formats: 8"SSD/Osborne/Kaypro/Apple/
Heathkit/Northstar/VT180+Rainbow/Xerox 820/
Micro Decision/Superbrain/NEC-8001

*10% restocking fee

Thoughtware, Inc.

800-821-6010 602-327-4305
Orders Technical

P.O. Box 41436
Tucson, AZ 85717

CIRCLE 80 ON READER SERVICE CARD

Microsystems

STAFF

Sol Libes	editor
Chris Terry	technical editor
Ian Darwin/Dave Fiedler/Dave Hardy/Bill Machrone/ Ernest E. Mau/Bruce Ratoff/Anthony Skjellum	contributing editors
Andrew Bender/David Gewirtz/Fred Gohlke/ Steve Leibson/Don Libes/Randy Reitz	assisting editors
Ann Ovodow	editorial coordinator
Tom Leander	editorial assistant
Mariano Nicieza	art editor
Jim Beloff	advertising director

ADVERTISING SALES OFFICES

New England, Midatlantic
Michael Mahana, *Microsystems*
Ziff-Davis Publishing Company
One Park Avenue
New York, NY 10016
(212) 725-7670

Advertising Coordinator
Rosemarie Caruso, *Microsystems*
Ziff-Davis Publishing Company
One Park Avenue
New York, NY 10016
(212) 725-5386

Southeast
Mark Browning, *Browning Publications*
P.O. Box 81306
Atlanta, GA 30366
(404) 455-3430

Midwest
William Biff Fairclough/
Jeff Edman, *The Pattis Group*
4761 W. Touhy Avenue
Lincolnwood, IL 60646
(312) 679-1100

Southern California, Southwest
Jeff Cohen
Ziff-Davis Publishing
3030 Bridgeway
Sausalito, CA 94965
(415) 331-7133

Northern California, Northwest
Jeff Cohen,
Ziff-Davis Publishing
3030 Bridgeway
Sausalito, CA 94965
(415) 331-7133

Canada
Frank Lederer, *The Pattis Group*
501 Eglinton Ave., E. #202
Toronto, Ontario
M4P 1N4

Direct Retail Sales
Lynn Kujawa,
Ziff-Davis Publishing
One Park Avenue
New York, NY 10016
(212) 725-7679

CONSUMER COMPUTER & ELECTRONICS DIVISION

President
Vice President Marketing
Vice President Circulation
Vice President General Manager
Creative Director

Larry Sporn
Jeff Hammond
Carole Mandel
Eileen G. Markowitz
Peter J. Blank

ZIFF-DAVIS PUBLISHING

Richard P. Friese, *President* Albert S. Traina, *President, Consumer Magazine Division* Paul H. Chook, *Executive Vice President, Marketing and Circulation* Phillip T. Hefferman, *Senior Vice President* Sidney Holtz, *Senior Vice President* Edward D. Muhlfeld, *Senior Vice President* Philip Sine, *Senior Vice President* Baird Davis, *Vice President* George Morrissey, *Vice President* Selwyn Taubman, *Treasurer* Bertram A. Abrams, *Secretary*

MICROSYSTEMS (ISSN #0199-7955) is published monthly by Ziff-Davis Publishing Company, One Park Avenue, New York, N.Y. 10016.

Second Class postage paid at New York, NY 10016 and at additional mailing offices. POSTMASTER: Send address changes to MICROSYSTEMS, PO Box 1987, Morristown, NJ 07960. Subscriptions are \$26.97 for 12 issues. Canadian prices are \$5.00 per year additional; other foreign \$8.00 per year additional (U.S. currency only). For information or questions about subscriptions phone: (800) 631-8112.

Copyright© 1983 by Ahl Computing Inc. CP/M is a registered trademark of Digital Research.

Editorial correspondence is welcomed and should be sent to: MICROSYSTEMS, One Park Avenue, New York, NY 10016. Phone (212) 725-6856.

For information on commercial advertising, write to: MICROSYSTEMS Advertising Dept., One Park Avenue, New York, NY 10016 or call Jim Beloff at (212) 725-3452.

Permissions: Material in this publication may not be reproduced in any form without permission. Requests for permission should be directed to Bette Amado, Ziff-Davis Publishing Company, One Park Avenue, New York, New York 10016.

MORROW

There's a certain kind of person who buys a Morrow business computer.

The kind of person who doesn't follow the crowd. In business. Or away from it. You've succeeded by making your own decisions.

And when it comes to a decision on computers, you know that you don't have to pay a lot of money to get a lot of computer. Morrow knows that too.

That's why we make a complete line of systems, including software, from \$1599 to \$2745. Plus letter-quality printers starting at \$595. All, with performance so reliable you'll probably never need the nationwide service we offer from Xerox.

But maybe you don't know this: We've just introduced a hard-disk system with more performance at a lower price than anything else on the market. Anything.

The new MD11 includes an 11MB hard disk; 400K of floppy memory; 128K RAM; 8K ROM; 2 serial, 1 parallel and a main frame communications port. Add the legendary speed of the Morrow controller, a complete package of software, plus a full-size terminal, and you may not be ready for the price: \$2745, complete.

Morrow has never built computers to please everybody. We build them for people who demand value.

It's simple. Those who know buy Morrow.

The computer for independent people.

Morrow, 600 McCormick Street, San Leandro, CA 95477
For the Morrow Dealer nearest you, call: (800) 521-3493
(415) 430-1970 In California

New 11MB MD11 for \$2745

CIRCLE 183 ON READER SERVICE CARD



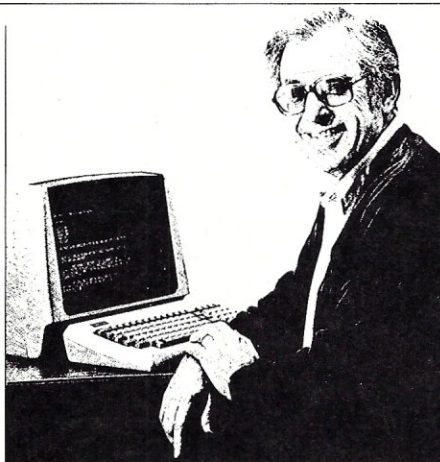
Editor's Page

by Sol Libes

Which is better—an 8-bit or 16-bit microcomputer? That is the current question. I think the answer is still unclear. There is no doubt that the 8-bit systems have some distinct advantages. First of all there is lots of software available for them—particularly the CP/M-80 systems. This will continue to be true in the foreseeable future because it takes a substantial period of time to generate a significant software base.

Secondly, the cost of an 8-bit system is always going to be less than that of a 16-bit system. One has only to compare the prices of 16-bit and 8-bit computers running a word processing package such as WordStar. For example, 8-bit machines such as the Morrow Micro Decision and Kaypro currently sell for half the price of 16-bit systems such as the IBM-PC and their look-alikes. This significant price difference appears to be based more on market demand than on the manufacturing cost of the product. A 16-bit system sure doesn't cost twice as much to build as an 8-bit system. Although I expect the price differential between the 8 and 16-bit system to decrease with time, it will always be there.

16-bit systems have two huge advantages over 8-bit systems. First,



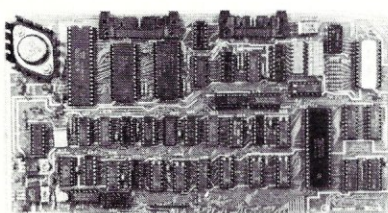
they can directly address much more memory, and second, they have larger and more powerful instruction sets. Thus we might expect the 16-bit systems to be more powerful and much faster than the 8-bit systems. However, the 16-bit systems introduced so far have not demonstrated that they are faster than the newer 8-bit systems. In fact, some are slower. The technology to make 16-bit based systems faster than 8-bit systems does not, as yet, appear to be in place. For example, the execution of a program such as WordStar is faster on the current generation of 8-bit processors (e.g., CompuPro 6 MHz Z80-based system) then it is on the

IBM-PC, which uses the Intel 8088 16-bit microprocessor. Further, software packages that run very nicely on 64K Z80-based CP/M systems "require" a minimum of 128K to run on a 16-bit system such as the IBM-PC. That is why the new version of IBM-PC now comes with 128K RAM as standard, and the next version is expected to have 256K RAM as standard.

There is no doubt that the instruction sets of the 16-bit micros are much richer than those of the 8-bit machines. Many are designed to support high-level languages, networking, multiprocessing and multiusers. Thus, as the marketplace moves toward the newer applications, the 16-bit machines will be the preferred systems.

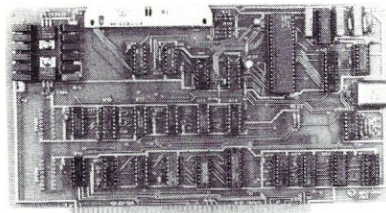
The trend in the current 8-bit market is one of increasing price sensitivity. For example, there are already several CP/M-80 systems with base prices of under \$1000. It is already possible to purchase a complete double-drive, 64K-RAM CP/M-80 for well under \$1300. I have seen the Osborne 1 system, which now lists for \$1295, on sale for under \$995. And I expect these prices to drop even further by year-end. CP/M-80 systems for under \$500 appear attainable in the very near future.

MCP MAKES HIGH PERFORMANCE S-100 BOARDS AFFORDABLE



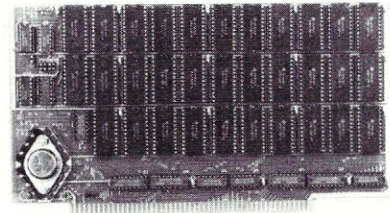
MCP/SCC-6 Six MHz S-100 CPU

- Six MHz Z80B, operates at 2, 4 or 6 MHz.
- Two full RS232 serial ports.
- Bauds rates from 50 to 19.2k.
- Three 8 bit programmable parallel ports.
- Monitor eeprom (2716) and 1k 2114 ram onboard.
- Eeprom and ram can be disabled on system boot. **PRICE \$200.00**



MCP/FDC DOUBLE DENSITY FLOPPY DISK CONTROLLER

- Single or double density operation.
- Single or double sided drives.
- Allows mixed density & mixed drives.
- Supports Shugart, Qume, Siemens, Mitsubishi or compatible 8" disk drives.
- CP/M 2.2 bios & support utilities are supplied on single density diskette. CP/M 86 & MS-DOS support available. **PRICE \$200.00**



MCP 64KS STATIC MEMORY BOARD

- High performance 150 ns Cmos ram.
- Extended addressing.
- Perfect for high performance Z80 and 8088.
- Available as 64K x 8 or 32K x 8 module.

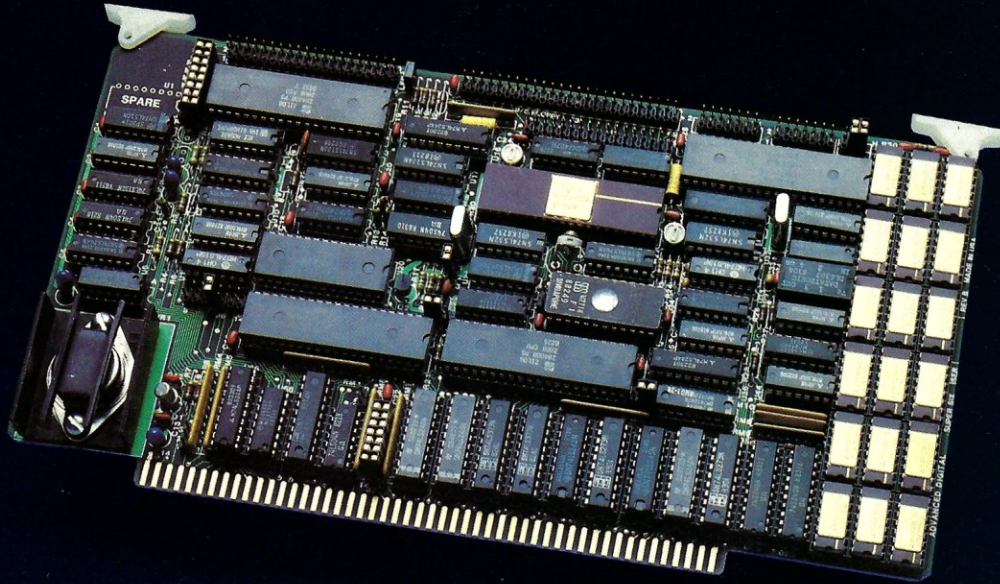
PRICE 64K \$238.00 32K \$180.00



MCP COMPUTER PRODUCTS • 6992 El Camino Real, Suite 104-444 • Carlsbad, CA 92008 • (619) 438-3270

CIRCLE 44 ON READER SERVICE CARD

SUPER SIX™

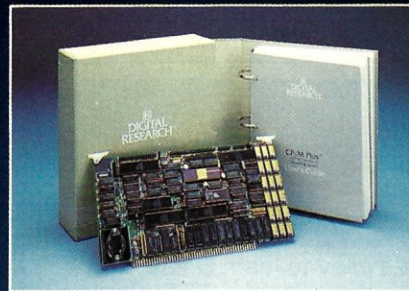


SUPER SIX, THE FIRST 6MHz S-100 SINGLE BOARD COMPUTER TO SUPPORT BANKED CP/M™ 3.0

SUPER SIX FEATURES:

- 128 KB of Bank — selectable RAM
- 6 MHz, Z-80B CPU
- DMA Controller
- 6 MHz, Z-80B DART (2 Serial RS-232 Ports)
- 6 MHz, Z-80B PIO (2 Parallel Ports)
- 6 MHz, Z-80B CTC (Clock Timer)
- Double/Single Density Floppy Disk Controller — Supports 8" and 5-1/4" Drives Simultaneously
- 2/4 KB of Monitor EPROM
- S-100, IEEE 696 Compatible

*CP/M is a trademark of Digital Research Corp. TurboDOS is a trademark of Software 2000 Inc. SUPER SIX and SUPER SLAVE are trademarks of Advanced Digital Corp.



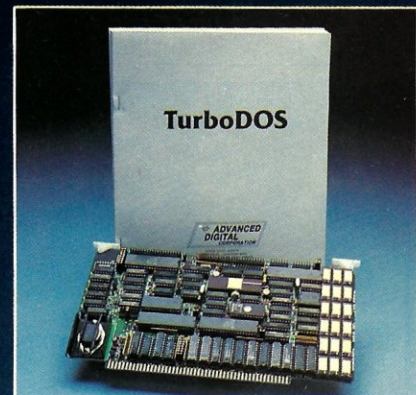
SUPER SIX & CP/M™ 3.0 A PERFECT MATCH

Advanced Digital has found the perfect match to its powerful, high-speed SUPER SIX single board computer. It's Digital Research's new CP/M 3.0. Because of SUPER SIX's 128 KB of RAM, it is the only S-100 board to support CP/M 3.0 in the banked mode; or run CP/M 2.2 with 64 KB of extra buffer.

SUPER SIX & TurboDOS™ ANOTHER PERFECT MATCH

When you combine the TurboDOS multi-user operating system with the 6 MHz SUPER SIX, you'll find your system running 1-1/2 times faster than

CIRCLE 148 ON READER SERVICE CARD



before. Add the 4 MHz or 6 MHz SUPER SLAVE™ processor board(s) and you will have the fastest multi-user, multi-processor system available today.

See the SUPER SIX at your quality computer dealer or contact:



5432 Production Dr.,
Huntington Beach, CA 92649
Phone: (714) 891-4004
Telex: 678401 TAB IRIN
See us at COMDEX Booths 378 & 481

NO SPEED LIMIT!



Move your software into the fast lane!
Be the king of your keyboard!
How?
SMARTKEY II™ gives you the power to convert any key to anything you want, as often as you want. In a flash, one keystroke can recall entire pages of text or execute difficult, repetitive commands.

You can *instantly* install all of your special function keys, no matter the terminal. In addition, our exclusive "super shift" feature allows you to redefine any key while retaining its original value.

In short, one key does it all.
SMARTKEY II™ is completely invisible to other software. It enhances any program, such as WordStar™, dBase II™, or Perfect Writer™.

The critics agree!
"Great! Nothing like it!" Peter McWilliams, Author of *The Word Processing Book*

SUPERCHARGE YOUR SOFTWARE WITH
SMARTKEY II™

COMDEX
Nov. 28 - Dec. 2
L.V. Convention Ctr.
West Hall Booth W200

"Excellent." Infoworld
"Versatile and reliable." Lifelines
"Works like a charm." Microsystems
"It's a very good friend." Micro Cornucopia
Time is money and **SMARTKEY II™** saves you both and all for only \$89.00
SMARTKEY II™ is the original of its type and has been on the market for more than two years. Beware of look-alikes with fewer features and less flexibility.
Ask about **SMARTPRINT™**, **SPOOL/UNSPPOOL™**, and other fine programs.

To order or obtain more information, call or write to:

HERITAGE SOFTWARE, INC.

2130 S. Vermont Ave., Los Angeles, CA 90007 / (213) 737-7252
Dealer inquiries invited.



SMARTKEY II™ runs on computers using standard versions of CP/M-80™, CP/M-86™, PC-DOS™, and MS-DOS™. Programs copyrighted by FBN Software. WordStar™ is a registered trademark of MicroPro, Inc. dBase II™ is a trademark of Ashton-Tate. PerfectWriter™ is a trademark of Perfect Software, Inc. CP/M™ is a trademark of Digital Research. PC-DOS™ is a copyright of IBM. MS-DOS™ is a trademark of Microsoft.



CIRCLE 95 ON READER SERVICE CARD

A \$50 CP/M D-BASE MANAGER

"ALIST is a good software package. It's easy to learn & easy to use"
Kent Stokes CP/M Review

"Does 90% of those more expensive managers at 1/10th the cost"
Gordon Jennings Irata Repairs

\$50 plus (shipping)
ALIST

- Easily Handles Thousands of Records Per File
- Up to 10 Data Fields Per Record
- 254 Characters Per Data Field
- Alphabetical Sort on First Field
- Variable Record Length
- Conditional Sorting and Reporting

\$80 plus (shipping)
ALIST+

- All Features of ALIST and More
- UP to 40 Data Fields
- Arithmetic Functioning on All Fields

Honor System Software

2562 E. Glade
Mesa, Az. 85204
(602) 892-2434

Satisfaction Guaranteed

Dealer Inquiries Invited

Az. Residents Add 5%



CIRCLE 52 ON READER SERVICE CARD

Editor's Page

continued . . .

The 16-bit area is presently a marketplace with a large variety of chips, which presents a problem for software developers. Software developers in the 8-bit market had it easier . . . they developed software either for 8080/Z80- or for 6502-based systems that dominated the market. And CP/M-80, which dominated the 8-bit arena, made it easy for software developers to write new software.

The 16-bit market is not clear, and hence we find a company such as Digital Research bringing out versions of CP/M for the 68000, 8086, Z8000 and 16032. And likewise there are versions of Microsoft's Xenix operating system for the 68000, 8086 and Z8000, and there may be an implementation for the 16032.

Thus a portability problem is being created in the 16-bit market, which would tend to limit its growth. DRI and Microsoft are attacking the problem by using the high-level C-language for software development, recognizing that although this leads to less efficient, slower-executing code, it does make transporting software from one system to another easier and faster.

The other problem facing software suppliers in the 16-bit area is the chaos that exists in disk formats, which presents a problem in software distribution. This was not a problem in the early days, because many 8-bit systems used the IBM 8" disk format and adopted it as the standard for software distribution. The 5.25" disk size has not seen a similar trend toward format standardization; however, some vendors have provided programs which allow files to be converted from one format to another.

Errata

CompuPro has notified us that an interrupt-driven I/O is now available for the 8/16C. It was not available to the author at the time the review was written ("Life in the Fast Lane: Three Multiuser Microcomputers," *Microsystems*, September 1983).

In addition, on pages 10 and 133 of the September 1983 issue, CompuPro's address was incorrectly given. The correct address is: CompuPro, 3506 Breakwater Court, Hayward, CA 94545. We apologize for any inconvenience this may have caused.

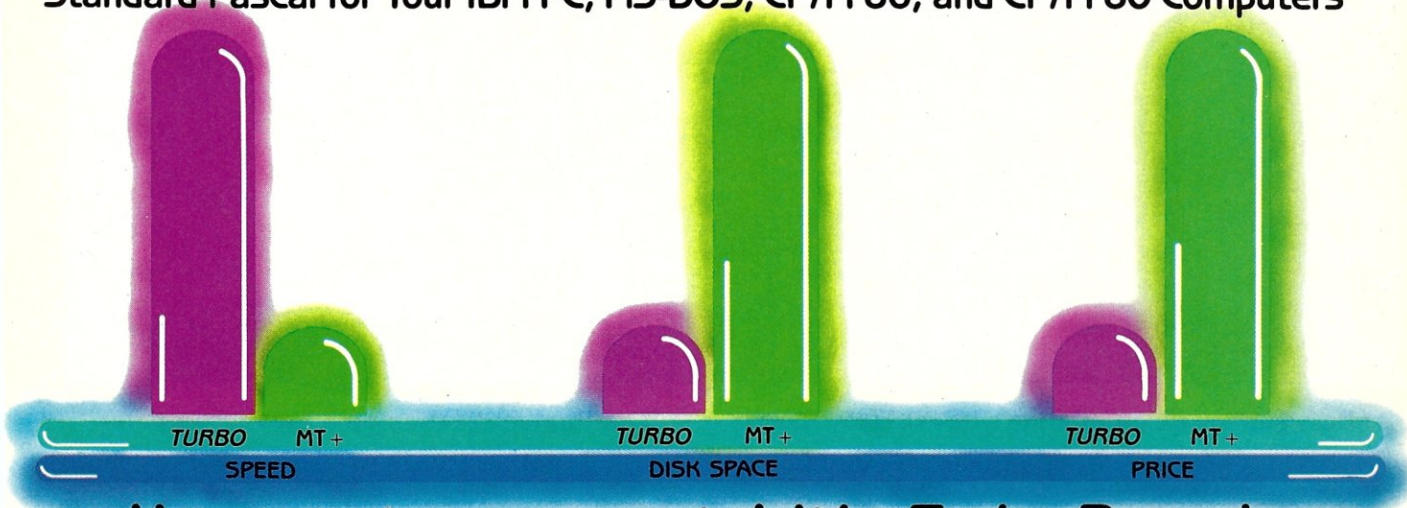


PASCAL

\$49.95

Introductory
Offer

Standard Pascal for Your IBM PC, MS-DOS, CP/M 86, and CP/M 80 Computers



Hang on to your seats! It's *Turbo Pascal*.

	<i>Turbo Pascal</i>	JRT	MT+
8 & 16 bit	YES	NO	YES
Editor	YES	NO	NO
Generate Object Code	YES	NO	YES
Locates RunTime Errors Directly in Source Code	YES	NO	NO
Compilation Speed *	1 s.	46 s.	69 s. includes linking
Execution Speed *	6 s.	69 s.	8 s.
Disk Space	27K including editor	85K + editor	168K + editor
Price	\$49.95	\$39.95	\$595.00

There has never been a Pascal compiler this good with so many powerful features. We know what you've been waiting for: a true Pascal compiler that works fast, offers a full screen editor, and has a great price.

Turbo Pascal has it all. First, we've included a built-in, interactive full screen, Wordstar compatible editor; it not only lets you correct errors, but during program compilation the cursor even jumps *directly* to the error and waits for your correction. No kidding. Second, it takes only 27K of disk space, including the editor; and on your microcomputer you need all the space you can get. *Turbo Pascal* is

10 to 70 times faster during compilation, as well as execution than Digital Research's MT+ or JRT Pascal.

Hard to believe your good fortune on the price? Don't worry. We're Borland, and we produce only quality, state-of-the-art software. Companies such as Micro Pro, Morrow Computers, Access and others distribute our software products, so you can't go wrong.

Place your order today. And we'll ship your *Turbo Pascal* out fast. For VISA and MasterCard orders call toll free:

1-800-227-2400 X 968

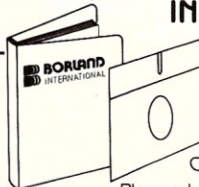
IN CA: 1-800-772-2666 X 968

Dealer and Distributor inquiries welcome.

Turbo Pascal \$49.95 + \$2.00 shipping per copy.

Check ☐ Money Order ☐
VISA ☐ MasterCard ☐

Card #: _____
Exp date: _____ Shipped UPS.



My system is: 8 bit _____ 16 bit _____

Operating system: CP/M 80 _____

CP/M 86 _____ MS DOS _____ PC DOS _____

Computer: _____ Disk Format: _____

Please be sure model number and format are correct.

NAME: _____

ADDRESS: _____

CITY/STATE/ZIP: _____

TELEPHONE: _____

Benchmark data based on EightQueens in "Algorithms + Data Structures = Programs" by N. Wirth (Prentice-Hall, publisher)

CIRCLE 17 ON READER SERVICE CARD

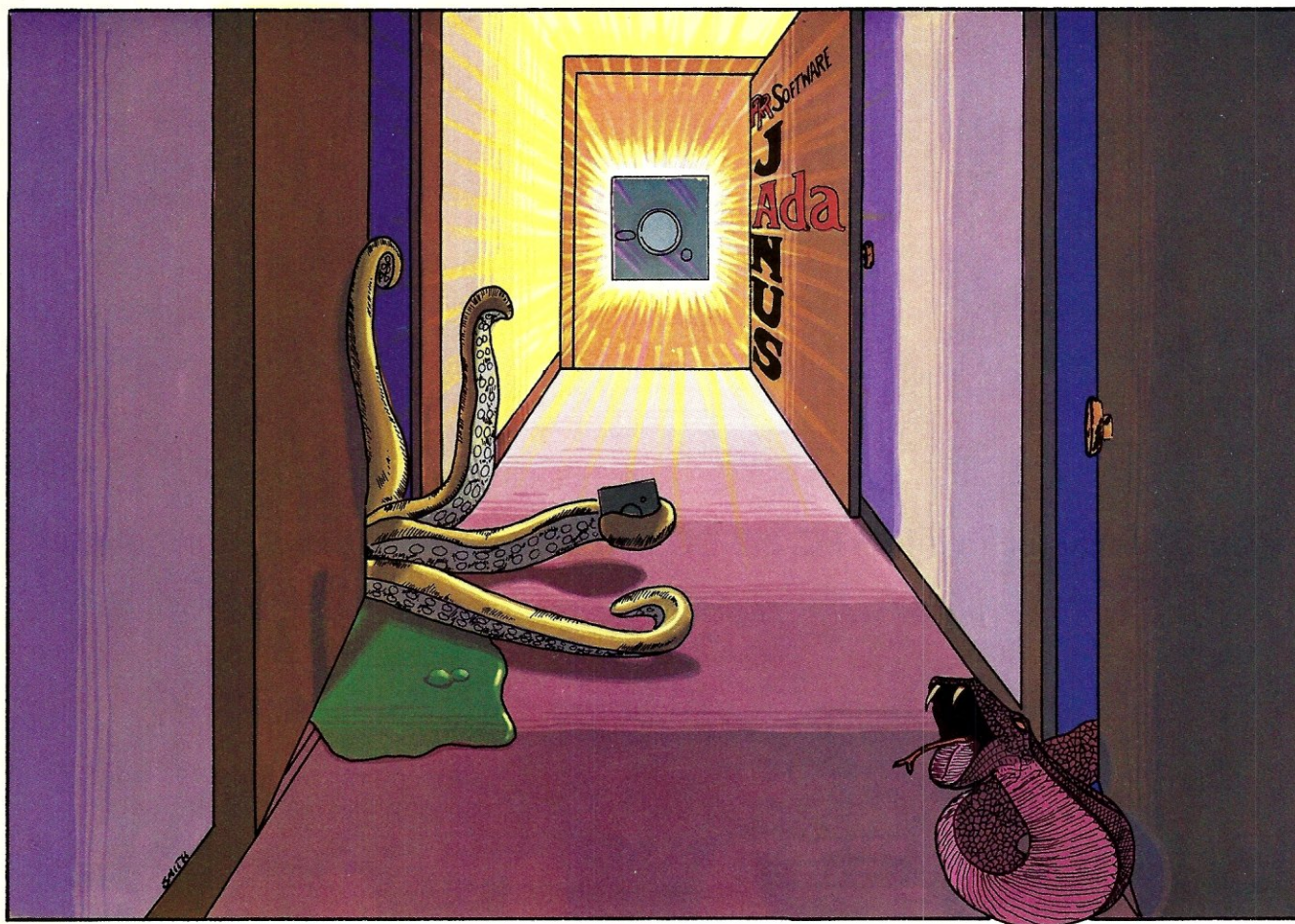
Turbo Pascal is a trademark of Borland International. MT+ is trademark of MT MicroSystems. JRT Pascal is a product of JRT. Wordstar is a trademark of Micropro.

BORLAND INTERNATIONAL

Borland International
4807 Scotts Valley Drive
Scotts Valley, California 95066

California residents add 6½% sales tax. Outside North America add \$15.00 for airmail, or \$5.00 for surface mail. Checks must be on a U.S. bank, and in U.S. dollars. Sorry, no C.O.D.

THE EASY CHOICE



Best Separate Compilation – Best Error Handling – Best Implementation on a Small Computer
Comments From 1983 LA AdaTEC Compiler Faire

"... JANUS/Ada encompasses at least 5 times as much of Ada as Supersoft, including many of the more exotic features of the language." Creative Computing

"... The compiler performed exceptionally well... the linker performs flawlessly... the error handling is excellent... RR's support is the best I've ever encountered." InfoWorld

"The compiler breaks new ground in the microcomputer field with its excellent runtime error-checking code and its excellent compiler error messages." Microsystems

"They're (RRS) honest to a fault, so they call their language JANUS; but its more nearly Ada than any other microcomputer implementation I know of... I watched some of the demonstrations and it works." Jerry Pournelle, Byte

Encouragement of this kind deserves a just reward; we now intend to complete our compiler and submit it for validation.

Our Ada line is available on the following operating systems: CP/M, CP/M-86, MS-DOS, PC-DOS and CCP/M-86

Available from the following distributors:

Westco, Inc.
 25 Van Zant, St.
 Norwalk, CT 06855
 (203) 853-9880

Marfam Corporation
 5340 Thornwood Dr. Suite 102
 San Jose, CA 95123
 (408) 226-0170

Suntex Data
 10175 Harwin Suite 100
 Houston, TX 77036
 (713) 271-9191

Internationally

S-100 Systems
 3687-4 Shobumachi
 Obayashi
 Saitama, Japan 346-01
 04808 (5)0416:
 04808(5)6565

Micronix
 11 Blackmore St.
 Windsor 4030
 QLD. Australia
 (07)57 9152

Nord-Micro Informatique
 155, rue du Fauburg St.
 Denis
 75010 Paris
 (1)205-39-47

CP/M, CP/M-86, CCP/M-86 are trademarks of Digital Research, Inc.
 *ADA is a trademark of the U.S. Department of Defense
 MS-DOS is a trademark of Microsoft
 ©Copyright 1983 RR Software

RR SOFTWARE, INC.

specialist in state of the art programming

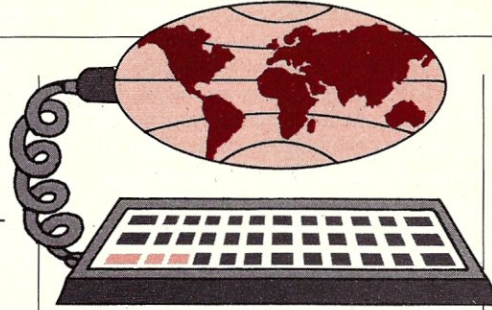
P.O. Box 1512 Madison, Wisconsin 53701

(608) 244-6436

CIRCLE 190 ON READER SERVICE CARD

News and Views

by Sol Libes



Random rumors

Western Electric's first desktop microcomputer is expected out before year-end. It is expected to be a UNIX-based system similar to terminals currently available from Teletype and should sell for about \$5,000. Look for it to use the Bellmac-32 32-bit microprocessor and contain 256K of RAM. Further down the road from WE is a lower cost desktop unit with videotex capability in the under \$2,000 bracket. And there is speculation that a \$200 low-end computer will be forthcoming . . . Digital Equipment Corp. recently reduced the price on their low-end VAX, the 11/730, by 30%, making it the first VAX available for under \$20,000. Next DEC is expected to introduce a desktop VAX unit to be designated the 11/610, using a "VAX-on-a-chip-set" and a new high-speed bus.

New SIG/M software

The SIG/M subgroup of the Amateur Computer Group of New Jersey has released 19 new volumes of public domain software. This brings their total to 136 volumes. They have also released a new version of their catalog describing all 136 volumes. The catalog is \$2 domestic (\$2.50 foreign). Write: SIG/M, Box 97, Iselin NJ 08830. These new volumes will be found on many RCPM systems and can be copied at meetings of many CP/M user groups (see the October *Microsystems* for a directory of these groups).

The contents of the new SIG/M volumes are:

Vol. Contents

- 118 XLISP—a Lisp compiler written in C with full source
- 119 Library Filing/Utility system and BYE program update
- 120 New version of that old standby MODEM (new version to be known as MODEM9) and Music Composer program for AY38910 sound chip
- 121 Updates for MODEM7, SMODEM and SD (Super Directory) programs
- 122 Updates for ZCPR2 for systems with 8080 micros
- 123 A mixed bag of programs
- 124 ZCPR2 and SYSLIB updates;

- ZCPR2 for Osborne-1
- 125 ZCPR2 and SYSLIB updates including ZCPR2 for Kaypro II and Morrow MD
- 126 ROFF4 text formatter
- 127 COMM7 communication program DISK7 file maintenance program and update of SAP
- 128 Updates of Bulletin board Software
- 129 dBASE II Order/Inventory program & JRT Pascal routines
- 130 RCPM Utility subroutines and programs
- 131 Miscellaneous Pascal/Z programs
- 132 More Pascal/Z programs
- 133 Even more Pascal/Z programs
- 134 Still more Pascal/Z programs
- 135 Utilities
- 136 Utilities for Big Board, MODEM for Osborne, Big Board, Datamax, & Sorcerer; YAM for Osborned, Kaypro, & Sanyo

Xenix goes commercial

Until now the Xenix operating system, from Microsoft, was available only to OEMs (original equipment manufacturers). The largest quantity had reportedly been supplied to 25,000 Tandy model 16 owners and about 10,000 Altos system owners. Microsoft has announced that it expects to begin shipping versions of Xenix 3.0 for the IBM-PC to about 100 selected dealers. Microsoft hopes to ship 20,000 copies by year-end and to more than double the number next year.

This version of Xenix reportedly implements UNIX System III and has been upgraded with a menu-based command shell similar to that of the recently updated MS-DOS single-user operating system (we will be doing an in-depth review of MS-DOS in an upcoming issue. Xenix

running on the Altos system was reviewed in the September issue). Xenix 3.0 is expected to be able to read and write MS-DOS files. Further, it will have enhanced electronic mail capabilities.

The full package will be 8.5 MB and furnished on 10 160K disks for the PC. The user is expected to transfer the software to his hard disk. Microsoft also plans to offer various books and manuals for users and programmers separately. To make the package more attractive and more compact, Microsoft will also make the system available in separate modules. The text-processing module that includes T-roff, N-roff and the Vi visual shell, will be \$395. A software development module is \$495. The single-user version will be \$395, while the multiuser version will be \$695. A plug-in memory management card will be needed as well as I/O cards for the PC.

Apple is expected to sell a similar version of Xenix for the Lisa. IBM decided not to market the product directly, and hence Microsoft is doing their own marketing. Microsoft is also known to be working on porting Xenix to the National Semiconductor 16000 series of micros. Demand for this is seen as low and thus not expected soon. However, Microsoft's European distributor, Logica Ltd., is known to have already ported Xenix to the 16000 and is expected to begin distribution soon.

In the meantime UniPlus+ from UniSoft Systems has been available for the Apple Lisa for several months now. It is being distributed by UniPress Systems, 1164 Raritan Ave., Highland Park, NJ 08904 (201-985-8000). It requires that the Apple Lisa have a second 5 MB hard disk drive since there is not enough room on the drive built into the Lisa, and the Lisa software must be resident. Furthermore, since the Lisa floppy disks are in extremely short supply, UniPress is currently requiring that purchasers send them the drive and they will put UniPlus+ on the drive and check it out. When Lisa floppies become available, they will furnish UniPlus+ on floppies for uploading.

Osborne woes

Rumor is that Osborne stockholders had to give up 50% of their stock last July to obtain \$20 million additional financing when the company couldn't meet its bills. The company had rough going when sales of the Osborne 1 dropped severely, and they couldn't ramp up production of the new Executive model fast enough. In the meantime, Osborne has been getting strong competition from Kaypro and Zorba. The latter, made by Telcon, was bought out by

Modcomp, a minicomputer builder.

Although Osborne is finally delivering the Executive, one other problem still exists. Osborne promised that the plug-in board to provide IBM-PC compatibility would be available one month after they began delivering the new machine. This is no doubt one of the reasons why people are attracted to the machine. However, they seem to be having trouble delivering this unit.

Osborne closed its New Jersey manufacturing facility and laid off

about 100 people, about one 11% of its staff. The company, which pioneered the transportable computer and packaged software concepts, was also the price leader when the original Osborne 1 was introduced. However, their price leadership is now a thing of the past, and many other suppliers are packaging software with their systems today. The transportable versions of the IBM-PC have taken away some business and the soon-to-be-announced transportables from IBM and Apple are expected to make further inroads.

Although Osborne Computer makes good systems, the basic problem appears to be that the marketplace is changing at a very fast clip and OC is just too slow to change. The Executive may prove to be too little too late. After all, the Kaypro can now be had with a 10 MB disk drive, and it had a larger screen and standard ports over a year ago.

Adam Osborne had hoped to make the low-cost Osborne-1 into a standard. However, refusal to make the machine a truly open system made it difficult (but not impossible) for independent vendors to supply software and peripherals for the machine.

Chapter 11 bankruptcy

Since the above was written, Osborne Computer filed for bankruptcy on September 15 under Chapter 11 of the Federal bankruptcy law. If the company is able to obtain emergency financing, it may continue to operate on a reduced scale, but many analysts are doubtful whether the company can survive.

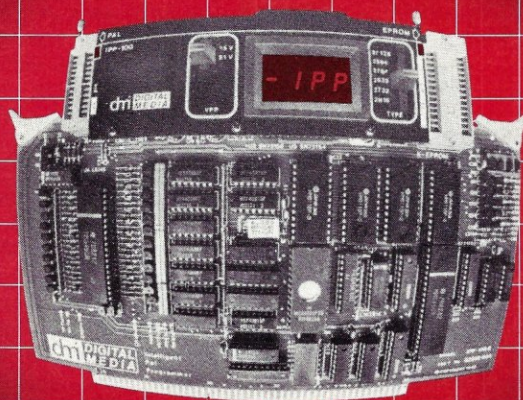
DRI vs. Microsoft

Even though Gary Kildall and Bill Gates say there is no battle, there certainly are all the signs of one. Losing the IBM-PC DOS battle to Microsoft has its pluses for Digital Research. As Gary Kildall said, "If IBM had not given the contract for its operating system, PC DOS, to Microsoft, we would not be as strong as we are today." There is no doubt that DRI is not the complacent outfit that it used to be and that it is learning how to fight.

The decision to release versions of all its software to run directly under MS-DOS was no doubt a very smart move. One no longer has to purchase

S-100

MICRO DEVELOPMENT



1 PAL PROGRAMMER 2 EPROM PROGRAMMER 3 ROM/PROM EMULATOR

An intelligent, multi-function instrument for microcomputer system development, the IPP-100B provides the convenience of programming PALs and EPROMs in-house. Or, if you want to emulate ROM or PROM, the IPP-100B does that too. And, the IPP-100B is affordable.

The IPP-100B is completely self-contained on a single S-100 Bus board (with NO external personality modules), and requires only a connector and power supply for use outside the S-100 environment. The board has an RS-232C port for use with other host computers. Furthermore, the IPP-100B is easy to use. In the firmware-driven DMATIC™ mode, insert a blank PAL and the IPP-100B does the rest.

FEATURES

- Programs 20 and 24-pin PALs (MMI-type)
- Programs 16K-128K EPROMs (selectable)
- Emulates up to 64K of ROM/PROM
- Copies from EPROM to PAL; Signature test compares PAL copy with master
- Verifies PAL/EPROM programs
- Burns last fuse for copy protection
- Selects high or low output logic levels
- Alphabetic messages prompt settings
- Selects EPROM programming levels
- Protected against reverse insertion
- Copies PAL data into EPROM

LEADERS IN INTELLIGENT, PROGRAMMABLE LOGIC INSTRUMENTS

CIRCLE 31 ON READER SERVICE CARD

dmi

**DIGITAL
MEDIA**

**DIGITAL MEDIA INC.
3178 GIBALTAR AVE.
COSTA MESA, CA 92626
(714) 751-1373
(714) 754-6317**

News & Views

continued . . .

CP/M to run them on the PC. They learned that if you can't beat 'em, then join 'em! And DRI is now offering an MS-DOS emulator that runs under CP/M-86 so that users can run MS-DOS software.

Now DRI has entered into an agreement with VisiCorp to support the Visi-On system under CP/M-86. Couple Visi-On with the multiprocessing capability of Concurrent CP/M and you have one hell of a powerful system. And in another move, IBM has finally agreed to market concurrent CP/M, packaging it up with a version of WordStar that takes advantage of the concurrency features.

DRI has also disclosed that it will soon release a fully ANSI-77-compatible version of Fortran and will add graphics to its Personal Basic. DRI is also known to be working with Digital Equipment Corp. to develop a smaller version of DEC's VMS operating system, and there is a rumor that DR is planning to enter the ROM-cartridge software market.



TIRED OF MAKING BACKUPS?

USE ERROR-CORRECTING dataCURE™

EASY TO RUN

NOTHING TO LEARN

PAYS FOR ITSELF

With dataCURE you request operations simply by typing a function number and a drive letter. Everything else is automatic.

You don't use PIP to make a backup copy of a diskette. Instead, you use a PROTECT function. This causes the diskette to be scanned track-by-track at high speed, creating special information in a pair of concealed files. This information is used by the CURE function to identify and fix errors. The special files reside on the original diskette. (They take up only about 5% of diskette space.) There are no backup diskettes to mount or dismount, and you can do it all with just one drive.

The diskette savings alone will pay for the product.

dataCURE IS BETTER THAN EVER

- NEW single-drive operation
- NEW TurboDOS® 1.21
- NEW P&T 2.2e
- CP/M® 2.2
- menu and command modes
- NEW total directory rebuild
- NEW skips unallocated groups
- NEW space overhead cut to 5%
- fixes an entire track
- supports all (!) formats

THREE WAYS TO BUY IT

- NEW \$19 demo diskette (\$10 upgrade credit)
- NEW \$149 slave overlay called from your programs
- \$99 standard system

Distributed in 8" CP/M format. NJ residents add 6%. All US residents add \$5 shipping and handling. Outside US add \$5 plus 20% and prepay in US dollars. Quantity discounts available. Dealer and manufacturer inquiries invited.

COLORADO ONLINE

VISA

40 Balfour Lane Ramsey, NJ 07446

MASTERCARD

201-327-5155

800-225-0103

CP/M is a registered trademark of Digital Research Incorporated.
TurboDOS is a registered trademark of Software 2000, Inc.

CIRCLE 167 ON READER SERVICE CARD

AZTEC C — 'C' PROGRAM DEVELOPMENT SYSTEM PORTABLE SOFTWARE APPLE CP/M IBM

WHY PROFESSIONALS CHOOSE AZTEC C

MANX SOFTWARE SYSTEMS

- AZTEC C is the most complete implementation of UNIX V7 'C' available for microcomputers.
- AZTEC C is portable. 'C' code can be freely moved between UNIX V7 and microcomputer systems. AZTEC C is available for PC DOS (MSDOS), CP/M 86 (MP/M 86), CP/M 80 (MP/M 80), APPLE DOS, MODEL III (IV), COMMODORE 64, and ATARI. All versions of AZTEC C are source compatible.
- AZTEC C is a complete development system that includes relocating assembler, linkage editor, library utility, debugging aids, overlay support, interfaces to Microsoft and Digital Research development software, and run time routines for I/O, utility, and scientific functions. Source for all library routines is provided.
- AZTEC C generates fast native code for the 6502, 8080, Z80, 8088, and 8086.
- Cross compilers are available for the 6502, 8086, 8080, and 6502 processors.
- Since its release in 1981, AZTEC C has been acquired by several thousand users. Commercial applications include a wide variety of business, scientific, word processing, database, entertainment and financial applications.

PRICE LIST

AZTEC C66	PC DOS (MSDOS)	\$249
AZTEC C86	CP/M 86 (MP/M 86)	249
AZTEC C80	CP/M 80 (MP/M 80)	199
AZTEC C65	APPLE DOS	199
AZTEC C65	COM 64 OR ATARI	199
AZTEC Cross Compilers	PDP-11	2,000
AZTEC Cross Compilers	Other	500

Order by phone or mail. Specify product and disk format. Check, Money Orders, COD, VISA, MC, and purchase orders are acceptable. NJ add 6% sales tax.

MANX SOFTWARE SYSTEMS
Box 55, Shrewsbury, NJ 07701

Order phone: (201) 780-4004
Tech information: (201) 530-7997
Tech support: (201) 530-7708

Shipping: COD, 2nd day delivery, or Canada, add \$5. Canada 2nd day or US next day delivery, add \$20. Outside North America, add \$20, and for 2nd day add \$75

CIRCLE 245 ON READER SERVICE CARD

Programming International

outside CA

(800) 222-8811

inside CA

(800) 631-4400

Over the phone

or

Face to face

SOFTWARE

to go

either way—

your best choice

LOCATIONS:

California

Palo Alto, CA 94301
(415) 324-1099

1370 E. Walnut Street
Pasadena, CA 91106
(213) 304-9166

16168 Beach Blvd.
Suite 151-S
Huntington Beach, CA 92647
(714) 841-5555

New Jersey

Two Executive Drive
Fort Lee, NJ 07024
(201) 585-9184

1930 E. Marlton Pike
Cherry Hill, NJ 08003

opening soon:

Chicago, IL
Pittsburgh, PA
Detroit, MI
Cleveland, OH
Denver, CO
Kansas City, MO
St. Louis, MO
Dallas, TX
Houston, TX

New Hampshire

3H Taggart Dr. (off Daniel Webster Hwy.)
Nashua, NH 03060
(603) 888-0231

Maryland

Montrose Professional Park
6204 Montrose Rd.
Rockville, MD 20852
(301) 770-1082

Store Hours:

10-7 Monday thru Friday
10-5 Saturday

dBASE II \$389

Smartmodem 1200B \$439

Quickcode \$195

Multiplan \$198

Lotus 1-2-3 \$369

APPLE II/II- DOS®

Business

Arise!	LIST	SALE
Magic Mailer	70	49
Magic Window II	150	109
Magic Words	70	49
Broderbund		
General Ledger w/AP	495	305
Continental		
CPA #1,2,3,4 (ALL 4)	1000	609
CPA #1-GL	250	159
CPA #2-AR	250	159
CPA #3-AP	250	159
CPA #4-PAYROLL	250	159
CPA #5-Property Management	495	352
FCM (First Class Mail)	100	75
Home Accountant	75	52
Decision Support		
Accountant With	149	112
DBCALC	129	97
Hayden		
Pleewriter/		
Multi 80 Column	150	108
Highlands		
EZ Ledger	60	37
Kensington		
Format II	150	113
LJK		
Letter Perc		
W/Mail Merge	150	112
Micro Lab		
Wall Streeter	300	216
Microsoft®		
Multiplan™	275	198
Muse		
Supertext Home Office	125	94
Supertext Professional	99	74
PBL		
Personal Investor	145	99
Sensible		
Sensible Speller	125	94
Sierra On Line		
Dictionary	100	70
Screenwriter II	130	85
Screenwriter	200	149
Silicon Valley		
Word Handler	199	145
Soft/Sys.		
Executive Speller	75	56
Software Dimensions		
Accounting + II GR	395	289
Accounting + II AR	395	289
Accounting + II AP	395	289
Accounting + II	395	289
Inventory	395	289
Accounting + II	395	289
Payroll	395	289
Accounting + II SOE	395	289
Accounting + II POE	395	289
Accounting + II POS	395	289
Synergistic		
Global Program		
Line Editor	65	49
Visicorp		
Business Forecasting		
Model	100	78
Desktop Plan	250	184
Viscalc	250	169
Visiplot	200	156
Database		
AST		
Versaform	389	269
Broderbund		
Bank Street Writer	70	53
Micro Lab		
Data Factory	300	216
Muse		
Address Book	50	36
Silicon Valley		
List Handler	90	68
Software Publishers		
PFS: File	125	94
PFS: Graph	125	94

PFS: Report	125	94
Stoneware		
DBMaster	229	148
DBMaster/Hard Disk	499	359
Utility Pak 1	129	99
Utility Pak 2	129	99
Synergistic		
Modifiable Database	80	59
Visicorp		
Visifile	250	169

Home/Education/Games

Beagle Brothers		
Alpha Plot	40	28
Eduware		
Algebra 1	40	30
Algebra 2	40	30
Algebra 3	40	30
Compu-Math/		
Arithmetic Sid	50	37
Compu-Read	30	22
Decimals	49	37
Fractions	49	37
PSAT Word Attack	49	37
SAT Word Attack	49	37
Spell Bee		
W/Read, Primer	40	30
Statistics	30	22
Lightning Software		
Master Type	40	30
Micro Lab		
English SAT #1	30	22
Learning System	150	108
US Constitution Tutor	30	22
Microsoft®		
Typing Tutor II™	25	19
Optimized		
Speed Read Plus	60	43
Synergistic		
Stargazer's Guide	30	23

Muse		
Dataplot	60	43
Omega Microwave		
Inspector	60	49
Locksmith	100	75
Penguin		
Comp Graphics/		
Apple Tablet	120	86
Complete Graphics		
System	70	50
Graphics Magician	60	45
Special Effects	40	30
Special Effects		
Apple Tablet	70	50
Phoenix		
Zoom Graphics	50	38
Sensible		
DOS Plus	25	19
Disk Organizer	30	23
Disk Recovery	30	23
Image Printer II	50	35
Multi Disk Catalog	25	19
Super Disk Copy	35	26
Sirius		
Pascal Graphics Editor	100	75
Southeastern		
Data Capture Vindex	90	65
Southwestern Data		
ASCII Express		
Professional	130	89
Printographer	50	38
Stoneware		
Graphics Proc. Sys. (standard)	69	52
Graphics Proc. Sys. (professional)	179	129
Vindex		
Videoterm Utilities Disk	37	28
Visicorp		
Visiterm	100	79
Visitrend/Plot	300	234

Programming International

inside CA (800) 631-4400
outside CA (800) 222-8811

Language

Microsoft®		
Applesoft Compiler (TASC)™	175	119
Mumath/Musimp (ADIOS)™	250	194

Utility/Comm/Graphics

Avant Garde		
Ultra Plot/DIF/Datagraph	99	71
Beagle Brothers		
Apple Mechanic	30	22
Beagle Bag	30	23
DOS Boss	24	17
Double Take	35	27
Pronto DOS	30	23
Utility City	30	22
Cane		
Menu Generator	40	29
Hayes		
Terminal Program	100	75
Insoft		
Electric Duet	30	23
Grafior II	75	56
Link Systems		
Link Index	195	149
Link Video	55	42
Lolus		
Executive Briefing System	199	149

APPLE III™

	LIST	SALE
Visicorp		
Business Forecasting	100	78
Model	300	234
Desktop Plan	400	312
Viscalc Advanced		
Link Systems		
Data Fax	249	187
Software Publishers		
PFS: File	175	129
PFS: Graph	175	129
PFS: Report	125	94

APPLE IIe™

Most Apple II products also run on the IIe (call for details). Products below are specially designed for the IIe.

	LIST	SALE
Sierra On Line		
Screenwriter II	130	90
Software Publishers		
PFS: File	125	94
PFS: Graph	125	94
PFS: Report	125	94
Visicorp		
Viscalc	250	189

APPLE HARDWARE™

Hardware

	LIST	SALE
Eastside		
Wildcard (for file only)	130	109
Hayes		
Micromodem II	379	259
Kensington		
System Saver Fan	90	69
LJK		
Lower Case Char Gen	25	19
Microsoft®		
16K RAM Card™	100	69
Premium System™	695	489
Softcard™	345	219
New Premium Card™	495	369
TG		
Joystick	60	45
Vindex		
Enhancer II	149	119
Videoterm with Softswitch	375	239

CP/M-80 (8" Standard SSSD)

Other formats are available as special orders thru Software to go.

Business

	LIST	SALE
ATI		
Power for CP/M	75	54
Artificial Intelligence		
Medical (PAS-3)	995	749
Ashton-Tate		
Bottom Line Strategist	400	279
Aspen		
Grammatik	75	56
Proofreader (32K or 80K)	50	38
Designer Software		
Palantir	425	319
Dictionics		
Random House Thesaurus	150	319
Digital Research		
Display Manager	400	295
Epic		
Superviz	150	94
Mark of the Unicorn		
The Final Word	300	223
Mince	175	139
Micro Pro		
Calcast	145	96
Mailmerge	250	165
Spellstar	250	165
Starindex	195	150
Word/Mail	695	426
Word/Spell	695	426
Wordstar Prof. (Word/Spell/Mail)	845	558
Wordstar	495	327
Microsoft®		
Multiplan™	275	198
Oasis		
The Word Plus	150	112
Select		
Select Word Processor	595	356
Sorcim		
Supercalc	195	129
Supercalc 2	285	179
Superspellguard	195	129
Superwriter	295	185

Database

	LIST	SALE
Anderson-Bell		
Abstat	395	359
Ashton-Tate		
dBASE II	700	389
dBASE II w/user's guide	729	409
Caxton		
Cardbox	245	177
Condor		
Condor 3	650	398
DJR		
FMS 80	395	275
Digital Research		
Access Manager	300	225
FYI		
Superfile	195	129
Fox & Geller		
Quickcode	295	195
Quickscreen/dBASE II	149	125
dGRAPH	295	195
dUTIL	99	59
Human Soft		
DBPlus	125	95
Micro Pro		
Infostar	495	327
Microsoft®		
Sorting Facility (MSORT)™	195	151
Optimal		
Accelerator™	195	
dCLONE™	295	
Pearl Soft		
Personal Pearl	295	229
T/Maker Co.		
T/Maker III	275	215
Home/Education/Games		
Inacom		
Deadline	60	43
Starcross	50	38
Zork I	50	38
Zork II	50	38
Zork III	50	38
Supersoft		
Dungeon Master	40	30
Nemesis	45	34
Language		
Digital Research		
CB80	500	395
CBASIC	150	94
Programmer's Utility	200	159
PL/I 80	500	375
Pascal MT+	350	262
Pascal MT+ with SPP	500	395
SID	75	63
ZSID	100	88
Microsoft®		
Basic 80 Interpreter	350	252
Basic Compiler	395	296
Cobol 80	750	562
Fortran 80	500	380
MACRO 80	200	150
uLisp/uStar	200	156
Supersoft		
ADA Compiler	300	225
C Compiler	250	188
Utility/Comm/Graphics		
Byrom		
BASTAM	200	149
Digital Research		
Despool	50	38
Microstuf		
Crosstalk/ Smartmodem	195	135
Supersoft		
Disk Doctor	100	75
Wolf		
Move It	125	83

HARDWARE, NOT MACHINE SPECIFIC

	LIST	SALE
Amdak		
Color II (RGB)	899	645
Hayes Microcomputer Products		
Chronograph	249	199
Smartmodem 1200	699	499
Smartmodem 300	279	209
NEC		
Monitor 12" Green Hi-Res	285	167
Novation		
J Cat	149	119
Smart Cat 103	259	207
Smart Cat 103/212	595	476



TELEPHONE ORDERS

Inside CA (800) 631-4400
Outside CA (800) 222-8811
Local (415) 324-3730

Order lines are manned 6:30—6 Monday thru Friday and 9—5 Saturday. Other lines are open 9—5 Monday thru Friday.

Technical Support (415) 324-0311
Order Status (415) 324-0306
Sales Manager (415) 324-0305

orders must be PAID by November 20 to qualify for these special prices

PROGRAMMING INTERNATIONAL

505 Hamilton Avenue • Suite 301
Palo Alto, California 94301

More CP/M®, Apple®, IBM PC®, UNIX® software, hardware etc. available; call for quote All sales are final.

TERMS: All prices subject to change without notice and availability. Cashier's check/MO/bank transfer. Allow time for company or personal checks to clear. Prices reflect cash prepaid discount. VISA/MASTERCARD/COD/PO's + 3%. CA residents add sales tax. All sales final for games & special orders.

SHIPPING: \$3 per item for UPS surface (\$6 for Blue Label) within Continental USA, except where shipping cost is specified in square brackets. UPS does not go to Canada, Alaska, APO's, FPO's; call for ship charge or add 15%—we will refund/credit difference.

RETURNS: All returns subject to managers approval, must have authorization number, obtained at 415-324-0305. Unauthorized returns will be refused; damaged goods will be refused. All returns subject to 15% restocking fee. No return after 30 days.

The S-100 Bus

by Dave Hardy

This column is intended as a forum on S-100 topics. I encourage readers to send in questions about the S-100 bus, which I will attempt to answer. Please write to Dave Hardy, 736 Notre Dame, Grosse Pointe, MI 48203.

In spite of its rather intimidating 100-pin bus, the IEEE-696 (S-100) bus is actually easy to use. Although there are simpler, more straightforward bus structures available (like STD, and those of many manufacturers, like Sanyo, etc.), all are less complete than S-100, and not nearly as versatile.

This month, instead of discussing the IEEE-696 bus definition, I'd like to discuss some simple S-100 I/O interfacing methods. Afterwards, I have some more interesting reader feedback.

Some simple I/O circuits

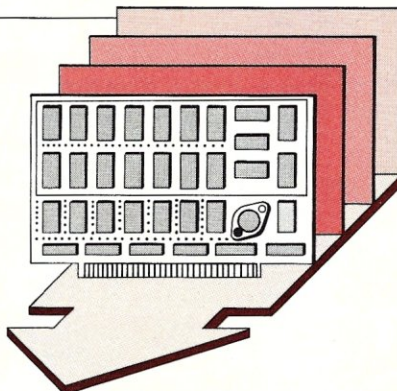
Most avid S-100 users have two things in common. First, they never have enough memory in their machines (nobody does), and second, they always need just one more serial or parallel I/O port to connect their newest peripheral.

Many S-100 users also have a third thing in common. They don't know how easy it is to add additional I/O to their S-100 machines. The circuits shown in Figures 2 and 3 illustrate some simple "bare-bones" parallel and serial I/O circuits that can be added to any S-100 machine.

Although these circuits perform different interfacing functions (one is a parallel interface, and the other is a serial interface), both demonstrate the basic techniques needed to interface I/O devices to the S-100 bus.

I/O addressing

In order to send data between the peripheral device and the S-100 bus, the interface must monitor several of the S-100 lines to determine when the bus is ready to input or output a piece of data. In addition, the interface must also decide if the data about to be transferred is to be transferred by it, or by some other interface. The interface does this by reading the S-100 bus address lines to see



if its own unique I/O port number (or group of port numbers) is being addressed (see Figure 1). This procedure is generally called "address decoding." If the number it reads doesn't match its own address (port) number, then it does nothing. If the number it reads *does* match its own address, then it assumes that the bus might want to talk to it. The address match causes the SELECT* line (shown in Figure 1) to go true (that is, it goes to a logic 0, since SELECT* is a "low true" signal). This

enables the rest of the interface, which is shown in Figure 2 (parallel) or Figure 3 (serial).

Notice that address decoder B in Figure 1 does not look at the least significant address line (A0). This is done to allow the decoder to detect more than one address. In this case, decoder B can detect any two consecutive addresses, starting on an even boundary, such as 0 and 1, 4, and 5, 98 and 99, and so on. Decoding only seven of the eight I/O address lines, however, makes it necessary to do further address decoding in other parts of the interface. For example, the 8251 USART shown in Figure 3 decodes address line A0 itself to determine internally whether data transfers are to be to/from its control registers, or its data registers.

Still more decoding

After determining that the I/O address is proper, a few other things still need to be determined by the interface. First, all that the address decoder does is read the address lines and tell the interface when they match. In the S-100 bus, I/O ad-

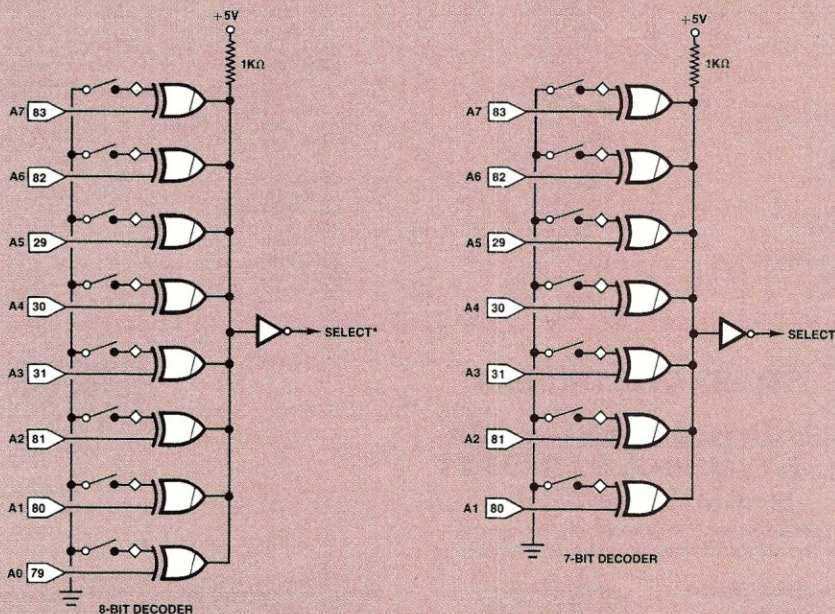


FIGURE 1 - TWO ADDRESS DECODERS.

HOW TO CONTROL YOUR CP/MTM MICRO—AT ONLY \$3. PER COMMAND.

A Remarkable Program For CP/M Users.

Of course, CP/M is a wonderful operating system. That's why so much serious business software has been created for it.

BUT, CP/M is not easy to work with. That's why you need to take the **POWER!** trip.

POWER! is a super-power-packed, user-friendly program that lets you take immediate and complete control of CP/M. And at a cost of only \$3. per command, it's the software buy of the year.

Over 55 Housekeeping Utilities.

POWER! is over 55 prompted, user-friendly CP/M utility programs all rolled into one 15k package. It takes care of all of these frustrations and more:

—**BDOS errors?** **POWER!** ends BDOS errors and gives you a way out.

—**Accidentally erased a file?** If you accidentally erase a program or disk file, **POWER!** restores the erased files.

—**Can't remember file names?**

POWER! assigns a number to each file on your disk. So, to copy files from disk to disk, you don't have to fiddle with PIP anymore. You just pick the file from a numbered menu and **POWER!** copies it for you. No more typing errors! **POWER!** also marks original files and their copies for you; and you can compare files to find identical copies regardless of name.

—**Lose data on a glitched disk?** If a glitched disk makes it impossible to call up a long word processing text, **POWER!** can fix the glitch. This means you may have to retype only a couple of sentences instead of losing 20 pages of text.

—**Trouble with "bargain" disks?**

POWER!'s disk testing function gathers any bad sectors of the disk into a special file so that CP/M thinks those parts of the disk are already used and never attempts to write to them. The rest of the disk is then safe to use.

—**CP/M scrolls too fast through text files?**

POWER! spools through files for you,

page by page, file by file, or line by line with instant halt by touching the space bar.

—**Need to reorganize files?**

POWER! sorts and formats the directory in 4 different ways. And you can easily copy or move files from user area to user area. **POWER!** creates 32 user areas instead of CP/M's 16.

—**Need to change memory?**

POWER! searches, displays and lets you change memory wherever you want. You can even automatically run software anywhere in memory. And you can inter-mix your search with as many wild card jokers as you need to find, for instance, all occurrences of "Sam Jones" and "Sid James" just by typing "S?J?J?". And **POWER!** also lets you read or write to any sector or track very simply.

—**Changing disks?** You can forget the ubiquitous Control C to change disks.

POWER! can do it for you automatically. And **POWER!** doesn't require a system disk in any drive, so Drive A is open for use, when **POWER!** is in control of CP/M.

—**Afraid of HEX numbers?** **POWER!** automatically converts Hex to Decimal, Binary or ASCII.

Special Password Protection, Too.

POWER! now includes a special program that lets you lock sensitive files, so that only you can access them. Without the secret PASSWORD which you can create and change at will, no prying eyes will ever know your secret file even exists. A great way to protect financial or scientific data from unauthorized eyes. Just this single program alone would be worth the price of **POWER!**, but there are over 55 more just as valuable programs in this power-packed-package.

At \$169., It's A Bargain.

Space doesn't permit describing all

the wonderful ways

POWER! can put you in complete control of your CP/M micro. But see for yourself. There's a Money Back Guarantee. At the low price of \$169., each powerful command costs you less than \$3. A true bargain!

POWER! Is Better Than Ever!

Eventhough "InforWorld", "Microsystems" and "Interface Age" call **POWER!** great, we have improved **POWER!**—including a completely rewritten 120-page easy-to-read documentation. (Previous purchasers of **POWER!** may exchange their original disk for an updated version with the new commands and a brand new manual—for only \$35.)

Take The POWER! Trip Today!

POWER! will operate in any standard CP/M or MP/M system, including CP/M-86, IBM PC, Apple (Z80 card), Osborne, Kaypro, HP, TeleVideo, TRS-80 conversions, S100's including NorthStar Vector, Morrow, CompuPro, etc. Up and running immediately, no configuration necessary—for hard disks and floppies.

At only \$3. per command, you can afford to **Take the POWER! Trip.** Call or send in your order today.

NOW AVAILABLE FOR MS-DOS, TOO.

ONLY \$169. Money Back Guarantee. Charge & COD Orders Welcome.

TOLL FREE (800) 428-7825 Ext. 96 AP

IN CA: (800) 428-7824 Ext. 96 AP

DEALERS AND OEM'S (415)

567-1634 Ext. 96 AP

COMPUTING!

2519AP Greenwich San Francisco, CA 94123

TOLL FREE (800) 428-7825 Ext. 96 AP

IN CA: (800) 428-7824 Ext. 96 AP

DEALERS AND OEM'S (415) 567-1634 Ext. 96 AP

ONLY \$169. Calif. add 6½% sales tax

☐ CP/M \$169. ☐ CP/M-86 \$169. ☐ MP/M \$249.

Card No. _____

Exp. Date _____

Computer _____

Your Name _____

Company Name _____

Address _____

City/State/Zip _____

**Take
The POWER!
Trip.**

CIRCLE 14 ON READER SERVICE CARD

NORTH STAR USERS

Convert to:

IBM PC

CP/M

MSDOS CP/M-86

Move Up To
APCBASIC
Rolls Royce of BASICS

UPWARD COMPATIBLE WITH
NORTH STAR BASIC
BUT TWICE AS FAST

- Faster than many compilers
- Sorts faster than conventional Basics
- Reduces programming time at least 30 percent
- Simple to use
- Easy testing and debugging
- Excellent TRACE and EDIT
- More memory available — Less required for programs
- Accurate arithmetic
- Excellent documentation and customer support

**DEMO DISK AND
MANUAL \$50**

**BUY NOW—SAVE \$25
\$375**

ORDER NOW!
Dealer inquiries welcome

Check VISA or MasterCard accepted

American Planning Corp.
Suite 423, 4600 Duke Street
Alexandria, Va. 22304
703-751-2574

CIRCLE 2 ON READER SERVICE CARD

S-100 Bus continued . . .

dressing *and* memory addressing are *both* done on the same lines, so the next thing that must be determined is whether the address that the decoder is seeing is an I/O address or a memory address. This is done by looking at the sINP and sOUT lines, which indicate if the read or write operation about to take place is an I/O operation or a memory operation.

Once the interface has decided that the bus operation about to take place *is* at its own address, and that it *is* an I/O operation, it then monitors the pWR* (for output) or pDBIN (for input) line to determine exactly when to transfer the data to or from the bus.

The following definitions for the S-100 bus lines that are used here should be of some help in under-

standing what is happening in the examples given:

pDBIN (processor Data Bus IN) pin 78, active high:

A generalized read strobe, asserted for memory read, I/O read, and interrupt acknowledge cycles. Used to enable a slave's data output bus drivers to gate data onto the S-100 bus.

pWR* (processor WRite) pin 77, active low:

A generalized write strobe, asserted for memory and I/O write cycles. Indicates to slave that the data output bus contains valid data.

sINP (status INPut) pin 46, active high:

Active when S-100 bus is executing an input cycle and reading from an I/O port address.

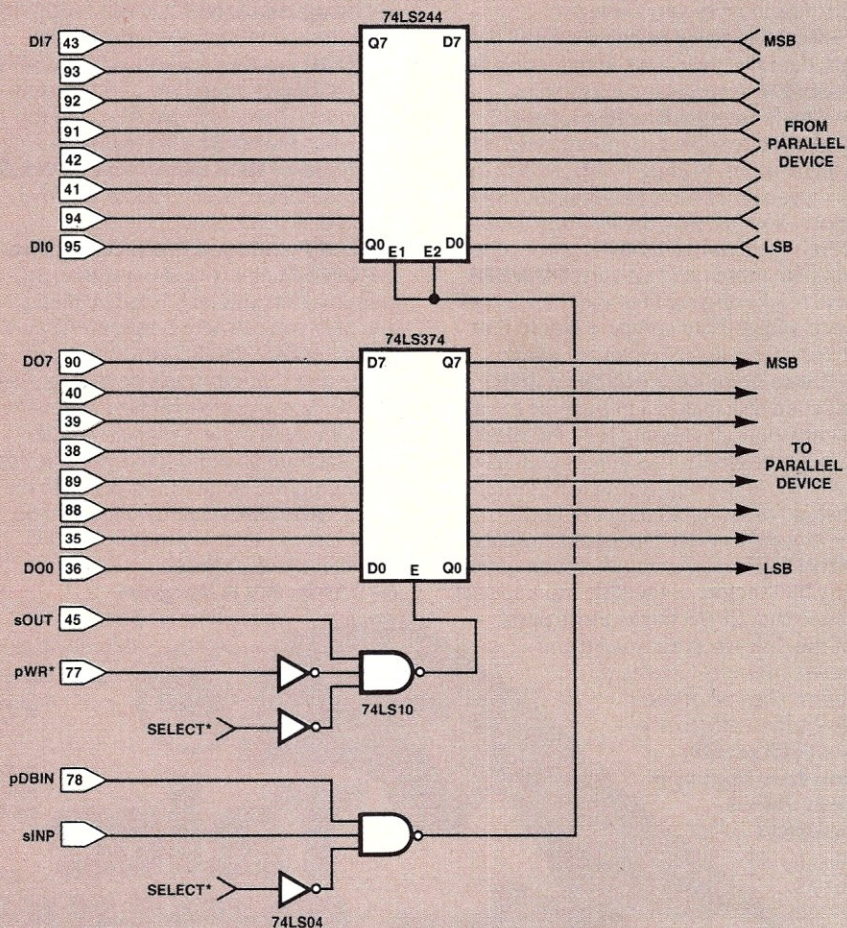


FIGURE 2 - A SIMPLE PARALLEL I/O PORT

S-100 Bus continued . . .

sOUT (status OUTput) pin 45, active high:

Active when S-100 bus is executing an output cycle and writing data to an I/O port address.

Although these definitions are not complete, and are not strictly in agreement with the IEEE-696 standard, they should be adequate for most simple S-100 interfacing projects.

Reader feedback

IEEE-696 compliance: I've received a number of letters from readers mentioning that many S-100 boards that are advertised as "IEEE-696 compatible" are actually not, because they lack 24-bit addressing or 16-bit I/O capability. The IEEE-696 standard actually says only that a bus master must assert at least 16 address bits, but *may* assert 24 address bits *if* extended address capability is desired. Furthermore, the IEEE-696-defined data bus consists of 16

lines grouped as two unidirectional 8-bit buses for byte operations, and as a single bidirectional bus for 16-bit word operations. If an S-100 master contains only an 8-bit processor, 24-bit addressing is useless without additional memory management devices, and word operations are just not possible. In other words, an S-100 board doesn't have to include every single feature of the IEEE-696 standard to be considered "IEEE-696 compatible," although I agree that some manufacturers may be stretching the truth a bit when they claim complete compatibility.

Mysterious missing interrupts:

Several readers have written mentioning that many interrupt-generating circuits (such as the one presented in the first "S-100 Bus" back in September 1982) don't work reliably. This is particularly true of the 8253-based circuit that I use myself. I had the same problem when I tried to install MP/M on my own S-100

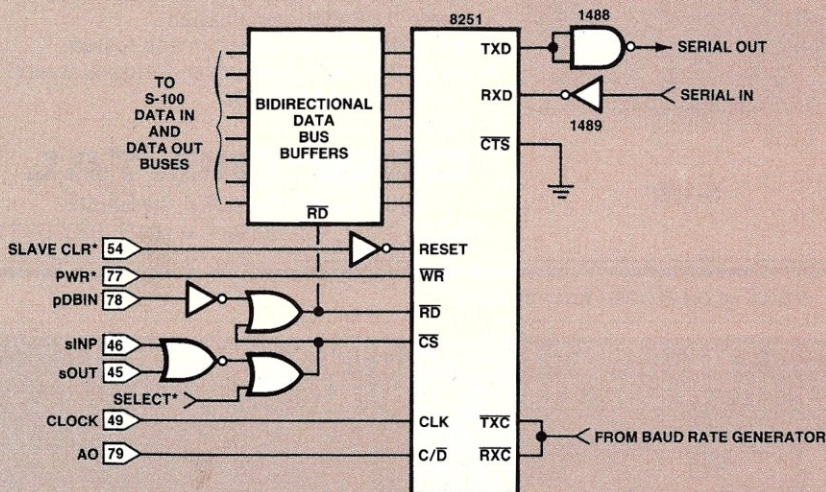


FIGURE 3 - A SIMPLIFIED SERIAL I/O INTERFACE

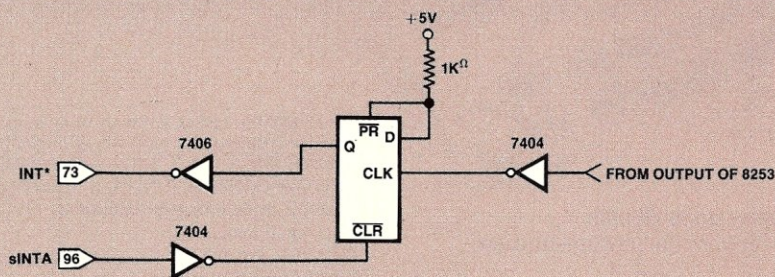


FIGURE 4 - "PULSE STRETCHER" INTERRUPT FIX CIRCUIT

Write more powerful applications with Idris, Whitesmiths' more powerful operating system.

To produce the high quality applications today's business environments require, you need a powerful, sophisticated operating system. Idris, the fastest, most complete UNIX-like system for micros, meets your needs. Idris offers:

- multi-user, multi-tasking capabilities
- networking, even between dissimilar computers
- application portability from Idris to UNIX and UNIX to Idris
- ROM-ability

SEND FOR OUR FREE BOOKLET
"THE PROFIT-BUILDERS' CHECKLIST"

Our new booklet gives you a quick and easy way to check the benefits of Whitesmiths' full line of products.

See for yourself how you can produce more powerful applications, cut your costs, widen your markets, and build your bottom line.

Idris is a trademark of Whitesmiths, Ltd.; UNIX is a trademark of Bell Laboratories.



Whitesmiths, Ltd.
97 Lowell Road
Concord, Mass. 01742
(617) 369-8499

NAME _____
TITLE _____
COMPANY _____
ADDRESS _____
CITY _____
STATE _____ ZIP _____
TELEPHONE _____

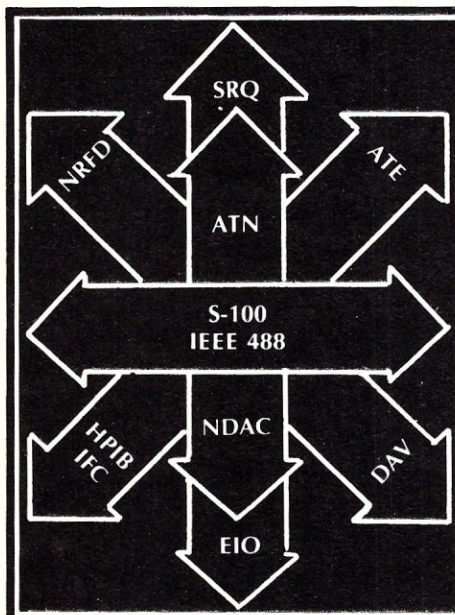
system. Although the 8253 was generating interrupts 60 times each second, the system was only being interrupted about 10 times each second, and not at regular intervals. The problem turned out to be that the pulse generated by the 8253 was just a bit too narrow for the processor to reliably see it. The circuit in Figure 4 is a "pulse stretcher" flip-flop that latches the INT* (interrupt) signal each time an interrupt pulse is generated, until the processor acknowledges the interrupt by returning

sINTA (status INTerrupt Acknowledge). I've been using this "fix" in my system for several months now without any problems.

North Star S-100 bus pinout differences: A few months ago, I received a note from Dave Kozinn (one of the SYSOPs of CompuServe's CP/M Interest Group) along with a list of the North Star CPU board's S-100 pin assignments. He mentioned that he would like to see a comparison of the North Star S-100 bus pinout and the IEEE-

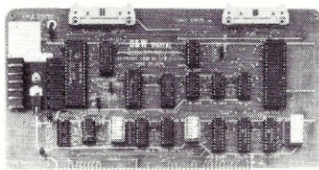
696 bus pinout. I've made the comparison, and they are quite different. If enough interest is shown, I will list the differences in a future "S-100 Bus"; otherwise, I will make the list available on the RCPM network and CompuServe. Basically, the differences are what would be expected, including the many redefined IEEE-696 lines such as address lines 16-23, the deletion of the old front-panel lines, etc.

Next time, we'll have a discussion of S-100 wait states.



THE 488+3

IEEE-488



S-100

IEEE 488 TO S-100 INTERFACE

- Controls IEEE 488 (HPIB) Instruments with an S-100 computer
- Acts as controller or device
- Basic and assembly language drivers supplied
- Meets IEEE 696 specification
- Industrial quality burned in and tested
- Up to 125K bytes/sec under software control
- 3 parallel ports (8255-5)
- \$375

D&W DIGITAL

20655 HATHAWAY AVENUE
HAYWARD, CA 94541 • (415) 887-5711

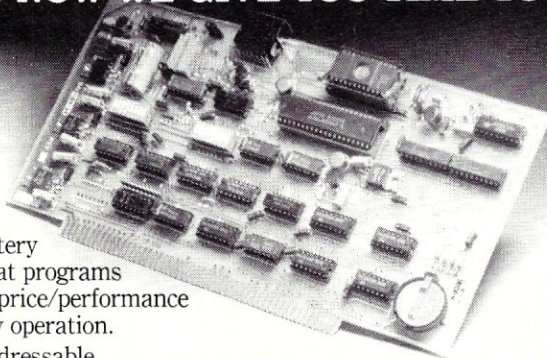
CIRCLE 66 ON READER SERVICE CARD

WE GAVE YOUR DRIVES THE FIRST BREAK THEY EVER HAD AND NOW WE GIVE YOU TIME TO BURN...

TimeEPROMmer, the S-100 CP/M* compatible programmer that's useful every second of every day. A real time calendar/clock with lithium battery and an EPROM programmer that programs all popular eproms. Unbeatable price/performance ratio. Features designed for easy operation.

Eprom Programmer: Port addressable. Read, Verify, Program, and Disk transfer. Handles up to 28 pins. Power generated and controlled on board. All software and documentation included. Assembled units tested with burn in.

Real Time Calendar/Clock: Complete time counting functions with CMOS LSI. Allows up to 6 months power down use. Independently port addressable.



TimEPROMmer BB & software & manual \$75
TimEPROMmer Kit & software & manual \$195
TimEPROMmer A & T software & manual ... \$295
Our DISK CONTROL UNIT that turns 8" drives off when not being accessed. State drive.
DCU, kit & manual \$29.95
DCU, A & T & manual \$49.95
P & H \$2. NYS add tax.
CP/M is T.M. of Digital Research

OPTRONICS TECHNOLOGY

P.O. Box 81 Pittsford, NY 14534 (716) 377-0369

CIRCLE 188 ON READER SERVICE CARD

APPLE IIe 64K RAM CARD

80 column x 24 lines

64K RAM

Compatible with
Apple IIe Software

\$149⁰⁰

PARALLEL INTERFACE EPSON TO APPLE

New From **\$49⁹⁵** CABLE INCLUDED
COEX

5 1/4" Floppy DISKETTES

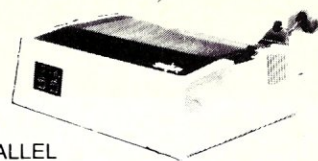
All Certified—100% Guaranteed

BOX of 100... **\$149⁰⁰**
Above with
Hub Rings..... **\$169.00**

BMC 12"
Green Monitor **\$95⁰⁰**

COEX 80-FT DOT MATRIX PRINTER

- 9x7 Dot Matrix, 80 CPS, Bi-Directional Printing
- 2K Buffered Memory
- 80, 96, 132 Columns, Graphics and Block Printing
- Selectable Char Pitch, Line Spacing and Feed



PARALLEL
COEX Interface Card to Apple .. **\$49.95**
Commodore Interface Card to
VIC, 64, PET..... **\$79.95**

\$240⁰⁰

for **APPLE**
16K RAM CARD
Language Transparent
COEX FACTORY **\$49⁹⁵**
WARRANTY

EXTENDER CARDS

for APPLE... **\$16.95**
for I.B.M.... **\$19.95**

FLOPPY DISK DRIVE

Apple IIe Compatible

with • Track Zero Micro Switch
• DOS 3.2.1 & DOS 3.3
• CP/M and PASCAL

DESIGNED
FOR YOUR **\$235⁰⁰**
APPLE™

Controller Card
for above..... **\$75.00**

DO YOU HAVE A COMMODORE?

NEW ROM for COEX 80 & DP8480
Allows Full Graphics Compatibility
with All Commodore Computers **\$29⁹⁵**

Now You Can Afford Another 64K...

Especially when it's less than
a half cent per bit!

Specifications:

- Fully Static Operation
- Supports S-100 IEEE—696 Standards
- Uses Popular 2716 Pinout Type Static RAM's
- Board Access Time Under 200nS
- 150nS RAMS Standard
- No Wait States Needed at 6.000MHz
- High Quality FR-4 Type PC Board
- Switch Selectable Phantom Line

- All Data, Status and Address Lines Fully Buffered
- Gold Plated Contact Fingers for Low Contact Resistance and Long Life
- Switch Selectable Extended Address Lines For Up To 16 M-bytes
- Extreme Low Power Dissipation (<500mA Typical)
- Top 8K May Be Switched Disabled and/or Interchangeable with 2716 Type EPROM's

COEX 64K S-100 CMOS

STATIC RAM BOARD

\$299⁰⁰
only
Assembled & Tested

"Have You Kissed Your Computer Lately?"

Components Express, Inc.

VISA

1380 E. Edinger • Santa Ana, Calif. 92705 • 714/558-3972

TWX 910-595-1565 • ADVACON SNA • International Orders Welcome

Terms of Sale: Cash, Checks, Credit Cards, M.O., C.O.D. Calif. residents add 6% sales tax.

master charge

CIRCLE 226 ON READER SERVICE CARD

The UNIX File

The UNIX File looks at many aspects of the UNIX operating system. If you have comments or questions about UNIX or this column, feel free to write to me, at the University of Toronto Computing Services (UTCS), 255 Huron Street, Toronto, Ontario, Canada M5S 1A1. If you're on the UNIX network "USENET", you can contact me at "utcsstatian".

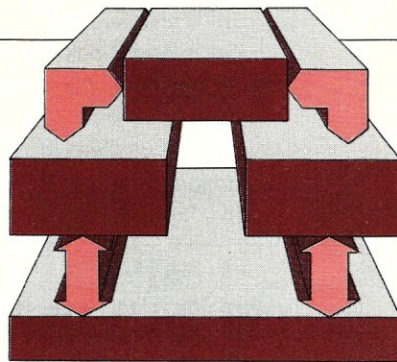
This month's column looks at the USENIX Conference in Toronto, tackles the myth that there is no software for UNIX, and looks at another introductory book on UNIX.

The USENIX Conference— Toronto, July 1983

The conference was great! I came away with about seven pages of type-written notes, just on the sessions I attended. There's no way I can condense all that to fit this column, and most of the talks will be in the proceedings anyway, so I'll just hit some of the highlights. The next USENIX Conferences will be January 17-20, 1984, in Washington, D.C., and June 12-15 in Salt Lake City. Circle those dates now if you want to be plugged into the mainstream of UNIX activity.

Western Electric started by announcing that the 'S' statistical package was now available for licensing, at a cost of \$8000. This is the commercial user price, per CPU(!). What they did not mention was that the previous, use-only nonlicense price had been \$150, and that they had jumped the price from \$150 to \$8000 with *no change in support* (i.e., none to begin with, and none now) and apparently no change in the software. The educational-only price goes up to \$400 per CPU.

Another package, the Writer's Workbench, was finally announced at a price of \$4000. And a product called the Instructional Workbench was announced at \$2500 in binary-only form. The others, and most all UNIX software products, have come in source form. *Western Electric*



seems to back the trend to binary-only distribution of UNIX software. This trend is resisted by the technical people but encouraged by some of the three-piece-suit crowd. Western as usual gave the figures on UNIX source licenses (currently 5,523 total) but refused to comment on the number of binary sublicenses that have been issued. Perhaps they don't know. The speaker said that the "figures floating around in the press, which range from 3,000 to 300,000, are very good numbers."

Focusing on the philosophy of computer usage and programming, Mike Lesk and Rob Pike gave excellent talks. Lesk discussed an experiment run in the technical library at Bell Labs, Murray Hill, on keyword searching vs. menu searching, and another (using the AP Wire) comparing menu searching against a user-provided keyword profile. Lesk concluded that keyword searching is more effective than menu searching for most applications, and that "novice modes" are not a very good idea. If the effort spent on "novice modes" in software were spent instead on better training for users, the computer would be a more effective tool. Pike spoke out strongly against the current habit of coding a solution without identifying the problem to be solved, and pointed out some examples from current Berkeley and Bell versions of UNIX.

This talk engendered considerable discussion, as did a later panel on "The Future of UNIX." The founders of UNIX were at the conference, and Dennis Ritchie sat on this panel. Ritchie commented that in the past, Bell and Berkeley had seemed to be going in different directions, but that now they were at least

talking to one another.

There were many technical talks on compilers, new implementations of UNIX, and a few comparing the newest systems (4.nBSD vs. Bell 3/5), several good papers on user interfaces (including speech input), and many, many other topics.

And then there were the social activities. Most of the major vendors had hospitality suites. Fortune Systems, not to be outdone, booked the Ontario Place Cinesphere theatre for a marathon of IMAX™ movies. The dedicated UNIX fans arrived after the Ontario Place shut down at 10 PM, and most were still gazing at the silver screen when the final flick flew by just before 3 AM. A few actually made it to the first technical session at 8 AM the next morning.

There was a lot of activity in the vendor area. UniSoft, celebrating their fiftieth port of UNIX to an OEM configuration, were demonstrating one of their ports of System 5 to the 68000. Others were exhibiting ports based on System 5, System 3, various Berkeley implementations, and the older but cleaner version 7. Hardware shown included Gould's micro, several 68000 machines, a few 16032 machines, and others. Shown for possibly the first time was the Teletype 5620, based on a Rob Pike design called the BLIT. The 5620 can run a small number of sessions (six) simultaneously through use of windowing à la Smalltalk, Apple LISA, etc. The sessions can be producing either text or graphical images, or both. All outputs are sent to the screen as they arrive from the host.

There's a lot more I could talk about. If you have questions about anything that went on, please feel free to write to me. Or better yet, make plans to attend one or both of next year's USENIX conferences.

Who says there's no software for UNIX?

I frequently hear an argument that goes something like "Well, UNIX may be a good operating system, but there's no commercially available software for it." Here's my attempt to counter this scandalous misrepresentation of fact.

COHERENT™ IS SUPERIOR TO UNIX* AND IT'S AVAILABLE TODAY ON THE IBM PC.

Mark Williams Company hasn't just taken a mini-computer operating system, like UNIX, and ported it to the PC. We wrote COHERENT ourselves. We were able to bring UNIX capability to the PC with the PC in mind, making it the most efficient personal computer work station available at an unbelievable price.

For the first time you get a multi-user, multitasking operating system on your IBM PC. Because COHERENT is UNIX-compatible, UNIX software will run on the PC under COHERENT.

The software system includes a C-compiler and over 100 utilities, all for \$500. Similar environments cost thousands more.

COHERENT on the IBM PC requires a hard disk and 256K memory. It's available on the IBM XT, and Tecmar, Davong and Corvus hard disks.

Available now. For additional information, call or write,

Mark Williams Company
1430 West Wrightwood, Chicago, Illinois 60614
312/472-6659



COHERENT is a trade mark of Mark Williams Company.

*UNIX is a trade mark of Bell Laboratories.

CIRCLE 87 ON READER SERVICE CARD

Urban Software has a UNIX software survey that contains *several pages of small print* listing software available for UNIX. The software listing comes as a sample database with their "Leverage" list management package, and is also included in hardcopy in the current issue of their *Urban Software Newsletter*. The list includes word processing packages, accounting systems, menu generators, compilers for most languages, databases, spreadsheets, and other goodies. Dozens of suppliers are list-

ed. And the list is not yet complete—they will be updating it periodically. Urban Software, 330 West 42nd Street, New York, NY 10036. Or call (212) 736-4030.

Another source of software is UniPress Software, Inc. This outfit seems to be trying to do for UNIX what Lifeboat did for CP/M, that is, make available a variety of software from a range of software manufacturers in the common distribution formats for the variety of small UNIX systems available. They sell

screen editors, word processors, and a (growing) number of other software packages. Write to UniPress at 1164 Raritan Avenue, Highland Park NJ 08904, or call (201) 985-8000.

In addition, there is a large body of public domain software available to UNIX users. Much of it is available through the UNIX network "USENET." I will have more to say about this in a later column.

Low-cost C program source

Although this is not just for UNIX, but for anyone with a C compiler, here's a company that supplies inexpensive C source programs. William Hutchison, Jr., of Algorithmic Technology sent me a catalog of software tools/utilities which range in price from \$0.10 (ten cents!) up to \$100. A dime (plus \$5 for a diskette) will fetch you object code (in CP/M format) for various public domain or copyrighted but freely distributed programs; the source for some of these is 25 or 50 cents. Most of the programs from the *Software Tools* books are here, recoded in the C language. The most expensive is an elaborate Sort program, at \$100. The smaller ones such as **grep**, **include**, **archive** sell for about a dollar each. The size of each file is given, and you add them up to find out how many diskettes you need to order. It all sounds good. I haven't seen any of the source code, and they only come on various 5" floppy formats. To get a copy of the catalog, write to Algorithmic at P.O. Box 278, Exton, PA 19341-0278. If you're on Compuserve or The Source, mail to [70665,1307] or TCT586 respectively.

A user-friendly book?

I am always sceptical when I see or hear the words "user-friendly." This phrase has been so over-used that it no longer retains an accurate meaning. It seems to be used to refer mostly to programs designed for someone with an IQ of 43 or below, which have rigid user interfaces that you can't speed up when you get tired of them, and which come with documentation that treats you like a moron. Perhaps I exaggerate, but only slightly. A recent article in *Byte* magazine claimed that a hinged keyboard contributes to the 'user-

CP/M users . . .

Make your move to 16-bit microcomputing... without ever leaving the 8-bit world.

From CP/M* to CP/M-86* or MS-DOS* and back...on command. That's the versatility CO-POWER-88™ brings to your CP/M machine.

CO-POWER-88 adds the power of 16-bit microcomputing—the potential for more memory, concurrent processing, multiaccess file systems and shared code—without impairing CP/M operation. Not only does your CP/M computer remain intact, you can even use CO-POWER-88 RAM as a simulated high-speed CP/M disk drive.

Built around the 8088 microprocessor, CO-POWER-88 provides dual-process-

ing power for almost any Z-80* or 8080 machine operating under CP/M (2.2)... including the Kaypro, Xerox, Big Board and ATR8000-CP/M personal computers.

A CO-POWER-88 costs only \$499.95 with 128 Kbytes of RAM; CP/M-86 with SWP's special BIOS is \$249.95 and 128-Kbyte RAM expansion (for 256 Kbytes total) is \$349.95. Or, save almost \$100 by ordering CO-POWER-88 already equipped with RAM expansion and CP/M-86—only \$999.95. Call for prices on CO-POWER-88/MS-DOS systems.

Available soon...IBM PC emulation software!

XEROX 820 Dual Density Upgrade	\$199.95
XEROX 820-II Ext. Dual Density Upgrade	\$100.00
BIG BOARD Dual Density Upgrade	\$150.00

SWP
MICROCOMPUTER PRODUCTS

We used to be Software Publishers, Inc.
2500 E. Randol Mill Road — 125
Arlington, Texas 76011
817/469-1181

ATR8000 and CO-POWER-88 are trademarks of SWP Microcomputer Products, Inc.; CP/M and CP/M-86 are trademarks of Digital Research Corp.; Kaypro is a trademark of Kaypro Non-Linear Systems, Inc.; MS-DOS is a trademark of Microsoft Corp.; Xerox 820 and Xerox 820-II are trademarks of Xerox Corp.; Z-80 is a trademark of Zilog Corp.

Yes...I'd like to know more about SWP's ■ CO-POWER-88
■ Dual Density Upgrades. Please rush me free literature.

Send to: SWP Microcomputer Products, Inc., Dept. 300
2500 E. Randol Mill Road (125)
Arlington, TX 76011

name

address

city

state

zip

MAIL TODAY!

DEALER INQUIRIES
INVITED

PRICES AND SPECIFICATIONS
SUBJECT TO CHANGE WITHOUT NOTICE

CIRCLE 75 ON READER SERVICE CARD

PROGRAMMING IN C ? BE SURE YOU GET ALL THE PHACT's !

base your C programming on
PHACT-dbrm
a multi-keyed (ISAM)
Data Base Record Manager.

PHACT-dbrm
is an easy to use library of C callable
functions for manipulation of records in
a database, plus high level database
manipulation tools.

PHACT-dbrm
supports: data dictionary; 5 datatypes; variable
length records; full database security; database
locking, data portability; ".h" file creation and
much much more!

PHACT-dbrm
runs on: all UNIX systems • IDRIS and UNIX look-
alikes • MSDOS • CP/M

PHACT-rql (Relational Query Language) **PHACT-rs**
(Report Generator) and **PHACT-rsg** (Relational Screen Generator)
under development.

PHACT-dbrm
is priced between \$250-\$950. (Source available)



ASSOCIATES LIMITED

To get all the PHACT's call DAVID GRAHAM at
PHACT ASSOCIATES Ltd • 212 • 420-1512
231 EAST 11 STREET • NEW YORK • NY 10003

CIRCLE 54 ON READER SERVICE CARD

UNIX SPOKEN HERE and MS-DOS, and VMS too!

UniPress, your UNIX source.

We have a line of software for a range of hardware, including VAX, MC68000
and IBM PC. Source code, as well as binary.
Quantity and OEM terms. Maintenance available.

PACKAGING: VAX/VMS and UNIX, MC68000/UNIX on Sun, Masscomp,
Apollo, Tandy 16, Apple Lisa, Sritek Board for IBM PC, Dual, Plexus, Callan, and
Cyb. Perq and Perkin Elmer, too. Inquire regarding other hardware.

UniPress Software

Priced from

UNIX SOFTWARE

- Full UniPlus+ UNIX for Apple LISA \$ 495
- EMACS—Multi-window text editor (Gosling version) 395
- LEX—Powerful word processor 500
- PHACT—Isam file manager 250
- /RDB—Relational database tools 250
- MENU SYSTEM—Menu generation 495
- UniCalc—Powerful spreadsheet 350
- MIMIX—CP/M emulator 495
- C cross compiler—to 8086 and 68000 (includes assembler, linker, etc.) 5000

MS-DOS SOFTWARE

- Software tools—Unix-like facilities add power to MS-DOS:
includes ed, grep, sort, diff, uniq, etc. 200
- PHACT—Isam file manager 250
- C compiler—Full C language 395

VMS SOFTWARE

- EMACS—Multi-window text editor (Gosling version) 2500

UniPress Software, Inc.

Mastercard and Visa

1164 Raritan Avenue, Highland Park, NJ 08904
201-985-8000 Toll Free: 800-222-0550 (outside NJ)

Unix is a trademark of Bell Laboratories.
VMS is a trademark of Digital Equipment Corp.
MS-DOS is a trademark of Microsoft.
UniCalc is a trademark of Lattice, Inc.

CIRCLE 79 ON READER SERVICE CARD

Bring the flavor of Unix to your Z80 CP/M system with Unica

*"Unicum: a thing unique in its kind, especially an example of writing.
Unica: the plural of unicum."*

The Unica: a unique collection of programs supporting many features of the
Unix operating system never before available under CP/M. The Unica are
more than software tools; they are finely crafted instruments of surgical
quality. Some of the Unica are:

- bc - binary file compare, display differences in hex
- cat - catenate files (vertically)
- cp - copy one or more files, even between users
- dm - disk mapper, reports free blocks and directory space
- fid - file identification by unique numbers (CRC's)
- hc - horizontal file catenation and column permutation
- ln - create file links (multiple names for one file)
- ls - intelligent directory lister, optional multi-columns
- mv - move (rename) files, even between users
- rm - remove (delete) files, with optional verification
- sc - source file compare, with resynchronization
- sfa - set/reset file attributes, optional verification
- sp - spelling error corrector, with 80,000 word dictionary
- sr - search multiple files for a pattern
- srt - in-memory file sorter, optional duplicate line omission
- tee - pipe fitting (copy input stream to multiple outputs)
- tr - transliterate (translate character codes)
- wc - word counter, counts characters, words, and lines
- wx - word extractor, copies each word to a separate line

Each Unicum understands several flags ("options" or "switches") which
control program alternatives. No special "shell" is needed; Unica commands
are typed to the standard CP/M command interpreter. The Unica package
supports several Unix-like facilities, such as filename user numbers:

```
sc data.bas:2 data.bas:3
(compares files belonging to user 2 and user 3);
Wildcard patterns:
rm -v *tmp*
(types each filename containing the letters TMP and asks whether to delete
the file);
I/O redirection:
ls -a >proj.dir
(writes a directory listing of all files to file "proj.dir");
Pipes:
dm b: | sr free >lst:
(creates a map of disk B; extracts those lines in the map which contain the
word "free", and prints them on the listing device).
```

The Unica are written in XM-80, a low level language which combines
rigorously checked procedure definition and invocation with the versatility
of Z80 assembly language. XM-80 includes a language translator which turns
XM-80 programs into source code for MACRO-80, the industry standard
assembler from Microsoft. It also includes a MACRO-80 object library with
over forty "software components", subroutine packages which are called to
perform services such as piping, wildcard matching, output formatting, and
device-independent I/O with buffers of any size from 1 to 64k bytes.

The source code for each Unicum main program (but not for the software
component library) is provided. With the Unica and XM-80, you can
customize each utility to your installation, and write your own applications
quickly and efficiently. Programs which you write using XM-80 components
are not subject to any licensing fee.

Extensive documentation includes tutorials, reference manuals, individual
spec sheets for each component, and thorough descriptions of each
Unicum.

Update policy: each Unica owner is informed when new Unica or
components become available. At any time, and as often as you like, you can
return the distribution disk with a \$10 handling fee and get the current
versions of the Unica and XM-80, with documentation for all new or changed
software.

The Unica and XM-80 (which requires MACRO-80) are priced at \$195, or
\$25 for the documentation. The Unica alone are supplied as *.COM
executable files and are priced at \$95 for the set, or \$15 for the
documentation. Software is distributed only on 8" floppy disks for Z80 CP/M
version 2 systems. All orders must be paid in advance; no COD's or
purchase orders, please. Quantity discounts are available. Shipment outside
of the US or Canada costs an additional \$20. Bank checks must be in US
funds drawn on a US bank.

Knowledge

P.O. Box 283-A
Wilsonville, Oregon 97070

Visa/Mastercard customers call (503) 638-0295 for next day shipment.
CP/M is a trademark of Digital Research. Unicum and Unica are trademarks of
Knowledge. Unix is a trademark of Bell Telephone Labs. XM-80 is a trademark of
Scientific Enterprises. Z80 is a trademark of Zilog Inc.

friendliness' of the machine.

And now there is a "User Friendly Guide to the UNIX Operating System." I am not exaggerating here. That is exactly how the book *UNIX Primer Plus* by Mitchell Waite, Donald Martin and Stephen Prata bills itself. It says so right on the cover. So I expected the worst when I started reading. Fortunately, I didn't get it. But neither did I find the ultimate introduction to UNIX. I did find a reference card to the UNIX commands,

the designer of which thinks that people need a diagram and instructions on how to fold up a simple reference card! If you can't fold a reference card without instructions, then perhaps even this book will be too complex for you.

What you do get with this book is an attempt to introduce the UNIX system to somebody who has never held a keyboard in his life. Now, the book is not written by acknowledged experts on UNIX. But it is not writ-

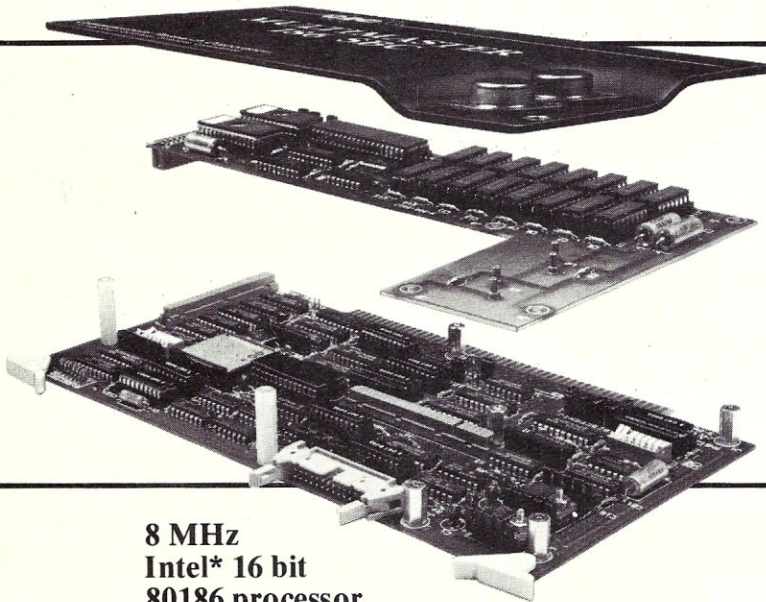
ten by nonprogrammers, either. The authors are experts with the CP/M system (and authors of various books on CP/M), and seem to have written this book as an exercise in learning UNIX. "We began learning UNIX through a trial-and-error approach that brought us a lot of surprises, some of them pleasant," they tell us. "Then we tried to pass on the benefit of our labors" by teaching others, and wound up writing a book about the system. So the authors can be forgiven for not including many of the advanced features of UNIX, since these have probably not come to their attention yet.

The book does give a general overview of the kinds of things that UNIX can do and is used for. Coverage of the basic command set is included. Both the *ed* line editor and the *vi* editor from Berkeley are covered. There is (not surprisingly in a book for nonprogrammers) little information on programming UNIX either at the shell script level or at the C language level; a simple interactive "hello" program is given in C, and information is given on invoking some other compilers (Pascal, Fortran) and on some other languages available. A comparison of CP/M and UNIX suffers from the authors' lack of familiarity with the UNIX universe, and includes the typical assumption that there is a dearth of "real" software for UNIX, a point I have already touched upon.

What I really wonder is this: Why write a detailed book on the system without teaching people how to program it? Many people don't want to write computer programs, they want to use them. Nothing wrong with that. I shouldn't have to build a car before I can drive to work. Most of these people will likely be locked into full-screen, menu-driven "user-friendly" software packages; many won't even see the underlying UNIX. Why do these people need to know about *cat*, and *ls*, and *wc*? If they aren't going to use UNIX at the UNIX level, these commands may well have no more interest to them than the throttle or instruments of a train they're riding on. On the other hand, if they're going to use UNIX as UNIX, then why not treat them as consenting adults, and show them the details of programming and the advanced features?

It seems to me that this book falls

NEW! FROM CRC! THE MULTIMASTER 186 SINGLE BOARD COMPUTER



**8 MHz
Intel* 16 bit
80186 processor**

- 5 to 10 times more powerful than current S100 systems.
- 128K byte on-board RAM.
- IEEE - 696/S100 bus interface.
- on board RS 232C port.
- Intel iSBX bus interface for daughter board.
- Switch master configurable as permanent master, temporary master of dummy permanent master.

AVAILABLE OPTIONS

Intel iSBX 218 Floppy Controller with CPM/86 BIOS ROM monitor.

Coming soon: 256K RAM and MS**-DOS

CALL 1-800-426-8075

For Complete Technical Data

CIRCLE 10 ON READER SERVICE CARD



COMMUNICATIONS RESEARCH CORPORATION

1720-130th Avenue N.E., Bellevue, Washington 98005


A subsidiary of Energy Sciences Corporation

—In Washington call 206-881-9550

*TRADEMARK OF INTEL CORPORATION

**TRADEMARK OF MICROSOFT

UNIX continued . . .

into a middle ground between two different marketplaces. If you want a book that gives nonprogrammers some information about the system, and holds back anything that might confuse them, then this is the book for you. The authors clearly love the system, and their enthusiasm will help carry nontechnical people along despite a few irrelevant cartoons and a few minor errors. For programmers, this book will be found wanting in detail, and I suggest the Bourne book as a more technical introduction to the system. The Lamuto book (*A UNIX Primer*, Ann and Nico Lamuto, Prentice-Hall) is of interest to nonprogrammers. Read what I said about it and the other books in the previous columns (*Microsystems*, July 1983), and decide for yourself. The Waite book is for some, but not for everybody. 

The opinions expressed in this column are those of the author, and not necessarily those of the University of Toronto or UTCS.

Real-Time C

for 8080, Z80

A Run-Time Library for Whitesmiths' C 2.1

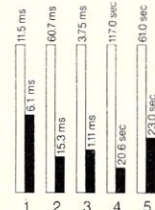
- Fast execution
- ROMable
- No royalties
- Fully reentrant machine support
- CP/M file support
- Error checking
- Usable with our AMX Multitasking Executive

Real-Time C \$ 95
 manual only \$ 25
 source code \$950

Intel mnemonic \$ 50
 to A-Natural converter

Benchmarks

1. Int to ASCII conv.
2. Long to ASCII conv.
3. Long random number generator
4. Double 20 x 20 matrix multiply
5. File copy (16kb)



■ with Real-Time C
 □ without

4 Mhz Z80, 8" SD diskette. Times may vary with processor, disks, etc.

AMX and Real-Time C are trademarks of KADAK Products Ltd.
 A-Natural is TM of Whitesmiths Ltd. CP/M is TM of Digital Research Corp.
 Z80 is TM of Zilog Corp.

KADAK Products Ltd.

 206-1847 W. Broadway Avenue
 Vancouver, B.C., Canada V6J 1Y5
 Telephone: (604) 734-2796
 Telex: 04-55670

CIRCLE 30 ON READER SERVICE CARD

C LANGUAGE TRAINING FROM PLUM HALL

- **C Programming Workshop:** Comprehensive, hands-on C course for programmers.
- **Advanced C Topics Seminar:** Includes Efficiency and Portability; for lead programmers.
- **UNIX Workshop:** Hands-on course in uses of UNIX; for general audience.
- Each is a 5-day course: available in-house or at public sessions.

Learning to Program in C

Thomas Plum

372 pp, 7 1/2"x10", Price \$25.

● AND AN INTRODUCTORY BOOK ON C LANGUAGE:

Learning to Program in C, by Thomas Plum, teaches C language from the ground up. With or without previous programming experience, anyone acquainted with computers will find a clear description of how C works.

You will find guidelines for writing portable programs that will run on a wide variety of modern computers—micro, mini, and mainframe, with excellent efficiency in all these environments.

PLUM HALL 1 Spruce Ave, Cardiff, NJ 08232
 Phone orders: 609-927-3770

- ☐ Send information on Plum Hall Seminars on C and UNIX™

- ☐ Check
☐ Mastercard ☐ Visa
☐ American Express

Exp. Date _____

Please send me _____ copies of "Learning to Program in C" (NJ residents add 6%; overseas add \$5 airmail.)

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Card No. _____

Signature _____ M

CIRCLE 77 ON READER SERVICE CARD

In the Public Domain

by Chris Terry

This month I'll be talking about hardware diagnostic programs. The public domain libraries contain very few diagnostics of this kind, perhaps because memory is about the only internal component for which one can set up a generalized program. Thus, I have found only one CPU diagnostic, one terminal test, three memory tests, and a program that surveys the current system and describes it.

CPU diagnostic

The CPU diagnostic (CPUDIAG, SIG/M Vol. 5) is a comprehensive hardware test of an 8080 or 8085 chip. It was contributed for noncommercial uses by Kelly Smith. The documentation is brief, but extensive comments in the source code are helpful in understanding what is being done. The program tests branch instructions of all types, register-to-register transfers, arithmetic and logical instructions, and load/store instructions. If an error is detected at any time, the test aborts with the message "CPU HAS FAILED!" and the address of the error exit is displayed. This diagnostic was intended to reside in ROM for system diagnostic purposes; the version supplied here runs as a CPM .COM file with BDOS calls for console I/O.

The ability to run the test at all presupposes that most functions are operating correctly. It can therefore serve as a positive assurance that the CPU chip is working properly, and this itself helps to eliminate some causes of trouble. It has also helped me to find a chip that was failing to set the Z flag after decrementing the B register from 1 to 0. However, diagnosis of a failing branch or I/O instruction would require a more elaborate program that could be loaded and monitored by an external processor rather than by the device under test.

Memory diagnostics

Memory diagnostics seem no longer to be as necessary as they once were. Chip reliability has increased enormously since the days of the old 2102, possibly because lower power consumption means less heat to be removed. Still, memory faults do oc-

casionally happen, and then you need a good memory test.

In deciding what constitutes a good memory test, a number of trade-offs have to be considered. The first of these is speed vs. resolution. A simple test for "sticky" bits in some location can run fast and requires little code. Such a test might consist of filling the area under test with zeros, checking every location, and then filling with OFFH and checking again. This would find only very gross faults. A refinement is to walk a 0 through a field of 1s in each location and then a 1 through a field of 0s; this will detect chips in which data lines are open or tied. A yet further refinement that will generally detect pattern-sensitive chips is to write and read all data combinations possible (i.e., 00 through FF for an 8-bit memory) to every location. This takes considerably longer to do, and modern chips seem to be less pattern-sensitive than the older ones. My experience has been that individual bits either work or they don't, in which case such faults are found by the "walking bit" test, whereas 2102s often had (or developed) marginally operating operational bits.

The real difficulty comes when address lines, either on the bus or within a particular chip, are open or tied. Under these conditions, some locations never get accessed, or get accessed by two different addresses. To find this kind of trouble, the test must fill the test area with a known pattern, write a new pattern to the current location under test, and then check all other locations to see that they were not affected by the new pattern in the location under test. The time required increases as the square of the number of locations be-



ing tested, and may amount to as much as 60 minutes for 4K. The basic principle of such tests is simple, but it is not easy to design the coding to pinpoint which chip is defective and the exact nature of the fault.

MEMTEST (CPMUG Vol.1) is a fairly simple test adapted from the Intel User's Group Library.

MEMDIAG (SIG/M Vol. 5) is an elaborate diagnostic that allows the user to select any block of memory above 1000H; the program itself requires the space below that address. The program tests 4K at a time, using any or all of the following tests:

- Galloping patterns
- Galloping columns
- Walking patterns
- Random patterns
- Write saturation (detects slow sense amplifier recovery)
- Static cycle check (detects data retention errors)

Error reporting is good, and the user has the option to run any or all of the tests continuously, accumulated error counts of various types being sent to the LST: device. This is probably one of the best memory diagnostics available from any source.

WORM8/8 (SIG/M Vol.17) is a specialized test designed to show up memory failures that occur because the Z80's access window is significantly shorter during an instruction fetch cycle than during a normal memory read cycle.

This program, first published by Henry Melton in *Personal Computing* (July 1979), was adapted to run under CP/M by Jim Eccleston. The Worm consists of a short 12-byte routine that breaks away from the main body and crawls up through the memory space, reporting its location as it goes. This routine also includes an RST 7 instruction as a trap which, if the program counter gets out of sync, attempts to return control to the error-reporting routines. When the Worm reaches ROM or the bottom of the BDOS, the system will be rebooted. This program is useful for the occasions when your memory test reports perfect memory, but you can't run a program. **U**

DISK MAKER I™

Software Houses • Distributors • Computer Stores

Are 5¼" Disk Formats a headache for you?

Missing sales because you don't have the right format?

Wasting time downloading software?

DISK MAKER I *will solve your problems!*

What is Disk Maker I?

Disk Maker formats, reads and writes over FORTY popular 5¼" disk formats on your existing S-100 computer. Adds up to four new disk drives which you can access as normal CP/M® drives

What is included?

An S-100 Floppy Disk Controller Board which supports 4 drives, any combination of 5¼" or 8"—double-sided, double-density, 48 tpi or 96 tpi. And extendable to the new 3" drives in the near future!

1 48 tpi double-sided, double density 5¼" disk drive, dual drive cabinet and power supply. A second 96 tpi DSDD drive is optional. Drive cables included.

Powerful Disk Maker software. DMFORM formats diskettes in any of over FORTY formats. DMSET automatically links Disk Maker with your CP/M system to create up to four additional disk drives on your system. You can then just copy any programs from your system's disk drives to Disk Maker's—using standard CP/M® utilities or our enhanced copy program.

What disk formats can I make?

Any of over FORTY formats. With the standard 48 tpi drive, you can make Osborne, KayPro, NEC, IBM PC (CP/M86), SuperBrain, Otrona Attache, Zenith Z-100, Heath (Soft Sector) and TeleVideo to name just a few. The optional 96 tpi drive adds DEC Rainbow, Altos, Eagle and more. And new formats as they are added.

How much does it cost?

Disk Maker I, with S-100 controller board, 1-48 tpi DSDD 5¼" disk drive, dual drive cabinet and power supply, cables and Disk Maker software is \$1500.00 (plus shipping). Please notice: There is no per format charge. All formats currently available are provided at no extra charge and future software updates are only \$25.00.

Options:

96 tpi DSDD 5¼" drive: \$385.00

8" DSDD drive, power supply & cabinet: \$840.00

Disk Maker II™

If you don't have an S-100 system, inquire about our standalone system: 6 MHz Z80B single board CP/M system with Disk Maker software, CP/M, one 8" DSDD drive and one 48 tpi 5¼" drive. Just plug in your terminal. \$2995.00.



**NEW
GENERATION
SYSTEMS, inc.**

2153 Golf Course Drive • Reston, Virginia • (703) 476-9143 • (800) 368-3359

TM: Disk Maker I, Disk Maker II — New Generation Systems; CP/M, CP/M86 — Digital Research

CIRCLE 19 ON READER SERVICE CARD

Letters to the Editor

Dear Mr. Libes,

I was glad to see the article by Ian F. Darwin on C programming ("The 50-Line Text Formatter," August 1983). I'm getting Small C now to try to learn the language myself, and the example was a good dry run for me. I will try to use it when I get my C.

However, Mr. Darwin may have been hasty in concluding that he needed to write it. ED certainly has its shortcomings—more of them than even WordStar. Nobody who has WordStar uses ED (except for everybody I know). ED is not a word processor. When I got WordStar I had Smartkey, written by FBN Software. It lets you substitute a string for any character on your keyboard. I used to put these strings in it:

```
sALAZ AZ
m59cs AZALAZ
-8t9t5z0tt5z0t
```

I used to use the first two macros to right-justify as follows:

1. Put myself at the head of a paragraph.
2. Use the T command to see how many lines the paragraph had.
3. Put that number, minus one, before the S macro that I had in Smartkey.
4. Tap zero to put myself at the start of the very long line that I had just created, and to look at it.
5. Put that same number (no, not the zero) at the start of the M macro.

Of course, I did "h n Op" before that, in order to save the text in case of booboos. H saves the text, N brings it back to ED, and Op shows it. That seems like lost of keystrokes, but it's faster than waiting for WordStar. Here is what the commands in the macros mean:

s	Substitute
AL	End of line marker (line feed, carriage return)
AZ	Terminate this part of the command
(space)	Put a space here in place of the end-of-line
m	Do all of this as a macro
59c	Go ahead 59 characters
s	Substitute
(space)	Get rid of the first space you see



AZ	Terminate this part of the command
AL	Put in an end-of-line

I used the -8t9t . . . macro to show where I was on the page. It does it all in one keystroke, and it does it right now. Here's what the -8t9t . . . macro does:

-8t	show 8 lines above
9t	show 9 lines below
5z	pause 5 periods of time (about a second)
Ott	show all of the line we're on
5z	pause 5 periods of time
Ot	show this line to the left of where we are

Why do some people still use ED sometimes?

- It doesn't put any loony, non-ASCII characters into your text
- You can print as many lines as you like wherever and whenever you want to—fast. And you do can do it from right where you are in ED.
- Everything about it is fast: getting in, doing simple processing, getting out, etc. I'll bet that ED is the fastest, in execution time, there is.
- You can do as many commands as you like before you tap carriage return to execute them—more speed.

I used ED to type this letter just to show everybody that I can still do it, and it was torture. WordStar has spoiled me. But ED is still the best for nonletter work. And if it were not for characters in which WordStar sets the 8th bit, you could even use it to correct WordStar files.

Dean Dwyer
1103 Cota St.

Torrance, CA 90501

Dear Mr. Libes,

I just finished reading the article by Jim Gilbreath in the August '83 issue on updating WordMaster. The information prompted me to write

for some help on getting a useful date out of MP/M and TurboDOS function calls for time and date.

The problem is that the MP/M "standard" for sending and receiving the date is to treat the current date as an integer equal to the number of days since December 31, 1977. I have never seen any simple assembly code that allows a program to change a "human readable" date like July 19, 1983 into a number usable by the MP/M standard. I have no idea why this method of date storage was used, and it would be a real help to programmers everywhere if *Microsystems* could publish some code to perform the date translation. In fact, a standard format to input and output dates is not a bad idea.

As you may know, TurboDOS (a networking CP/M-80 replacement) supports most of the MP/M 2.0 and CP/M 3.0 function calls, including the date functions. There are several utilities provided with Turbo that manipulate the date, so I know it is humanly possible to do so. The problem is that I have never found any easy source code (hopefully in assembly language) that allows a mere mortal to use the date functions as part of other programs. This may be why there is a complete absence of time and date support in all the CP/M languages that operate under MP/M (and Turbo).

I hope you have the answer or have access to someone who can provide the needed code. Computers have reached a level of sophistication that is amazing even to those of us who build them, and it is a shame that the machines cannot easily tell us what the date is.

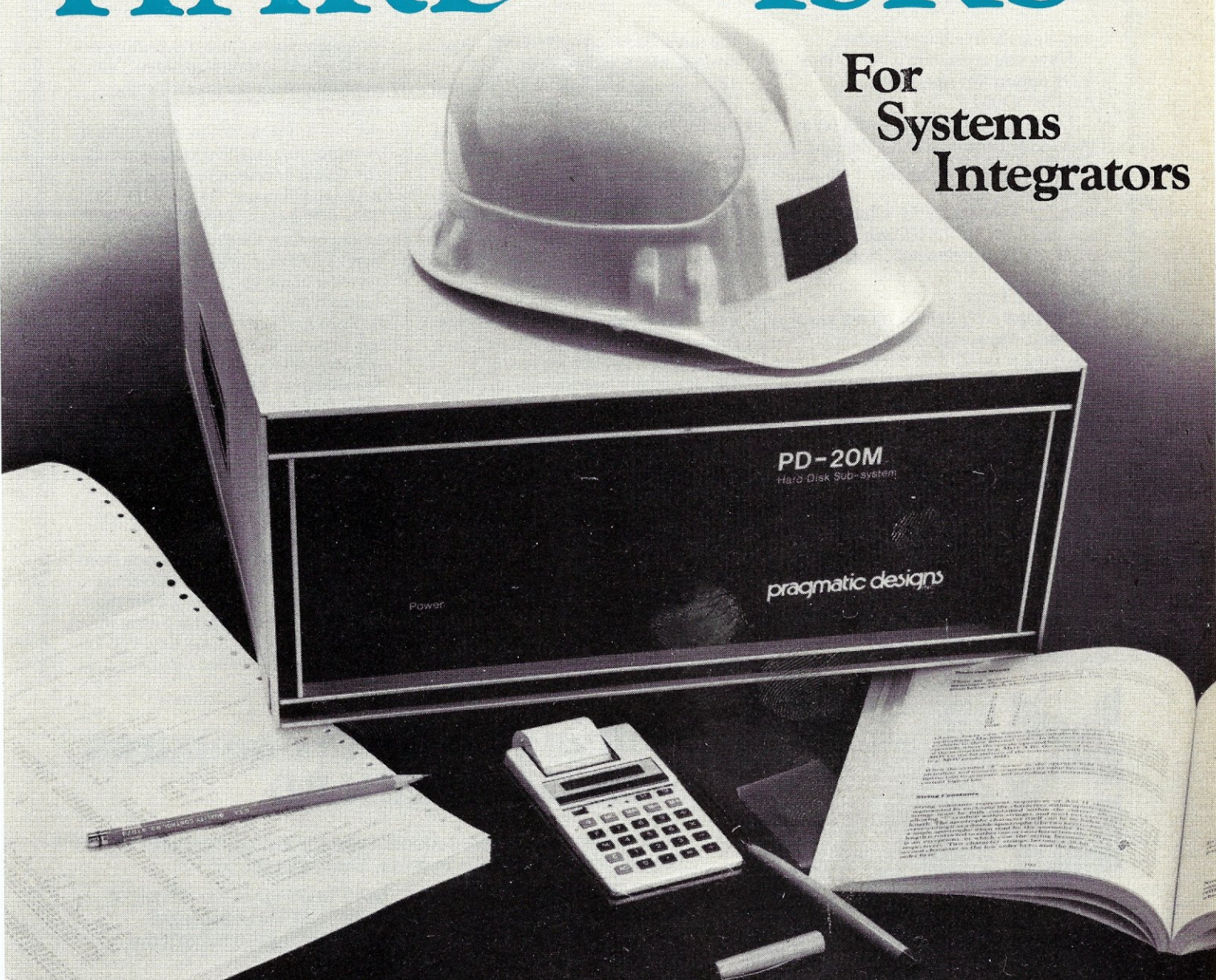
Arthur M. Zatarain
Principal Engineer
Dataran Corporation
808 N. Causeway Blvd.
Metairie, LA 70001

Dear Mr. Ashdown,

Many, many thanks for your XERA, as listed in the August 1983 *Microsystems*. Since I am a Pascal programmer (but not an assembly language programmer) and am stuck with CP/M (I purchased a Vector 4/30), your program was a godsend. Being naturally finger lazy, I named the program D (for delete) and now find computer housekeeping not

HARD DISKS

For
Systems
Integrators



Whether you're an OEM, system integrator, or end user, when the time comes to add a hard disk unit to your computer you want a building block that offers high performance, quality, and cost effectiveness. The Pragmatic Designs PD-10M, PD-20M, and PD-40M all provide these features and more.

All Pragmatic Designs hard disk sub-systems are designed for use in systems equipped with the CompuPro® Disk II hard disk controller. They can also be used with other OEM controllers which support the popular SA-4000 hard disk interface. Standard features include:

- 10, 20, and 40 Megabyte formatted storage
- 11.7, 23.4, or 47.5 Megabyte unformatted storage
- Fully compatible with CompuPro Disk II controller
- Heavy duty power supply with 110/220V capability
- 19" rack mount configuration available
- 1 Year limited warranty
- Full hard disk system including controller, cables, and software available

Hard disks... easy solution. If you're ready to add a full capability industrial grade hard disk sub-system to your computer system then call Jerry Hall at Pragmatic today.

pragmatic designs
INC.

Pragmatic Designs, Inc., 950 Benicia Ave., Sunnyvale, CA 94086 408/736-8670 TLX: 171627

™ CompuPro is a registered trademark of Godbout Electronics
CIRCLE 186 ON READER SERVICE CARD

only anxiety free but enjoyable.

Have you a similar fix for PIP (a Y/N option for, say, PIP A:=B:*.COM)?

For all of us out here, again many thanks for turning a chore fraught with peril into a task laced with pleasure.

George R. Chamberlin
73 Hillside Avenue
Englewood, N.J. 07631

Dear Mr. Terry,

I've been a bit behind on my reading, so it was yesterday that I was scanning through *Microsystems* while eating at my neighborhood Chinese restaurant. I was delighted to see your review of my program, DIMS (May 1983, p. 132).

I'd like to point out that another thing that makes DIMS unique, besides the continuous automatic back-up, is the storage method. Fields are of random length within fixed-length records. This is a compromise straddling between the present commercial programs. In dBASE, for example, all fields are fixed-length, and all

the unused space is saved. My local address file of 645 records takes 136K in dBASE, 84K in DIMS, and 56K as a comma-delimited sequential file (using quotes only when necessary). This is with 4K blocking on my Morrow hard disk. dBASE searches records at least three times faster than DIMS at its fastest (find).

Two more features not in dBASE: data in any field may be carried from the previous entry by entering ";" and RETURN. Scrolling screen formats may be set up—the industry is stuck on "one record at a time" displays right now, but these are ergonomically inferior to a scrolling entry display that shows context and helps you keep your place.

There are a couple of known bugs. I'm enclosing the notice that upgrades to version 1.02; I don't know whether the SIG/M release includes these fixes or not, or even if it includes all the files in the system. I have also done some minor debugging in the display of nonscrolling forms recently.

There is a bug in the DSORT.BAS

program. Do not use descending-order sorts. It is data-dependent; descending-order sorts crash sometimes in line 2730 or 2750 when HI = -1; I don't know how to fix it. A minor bug in the sort program is the way it concatenates fields to make the key; i.e., DUGANDAN. This will sort George Duganasi ahead of Dan Dugan. I think it would be better if the program inserted a high-ASCII character like 126 into the key when concatenating.

You can display and enter fields in any order in a designed format; guess my documentation obscured that. See the array SQ() in FORFORM.DWS, which determines what fields to use and their sequence. It is also possible to omit a field in either the screen or printer form independently by entering a negative number in either FL() or LFL() respectively.

I was pleased to get feedback from the Yankee Osborne Users Group, who have converted DIMS for the Osborne; contact Martin Lewis Jr., 100 Hartford Rd., Simsbury, CT



...nothing on Earth compares with DATAFLEX 2.0

Incredible power, un-precedented speed, and application flexibility for virtually any mission. That's DataFlex!

And now, the new DataFlex command language is the friendliest way you can deliver your software payload. All of the extraordinary state-of-the-art features of DataFlex 2.0 make it the clear choice for an applications data base.

But there's an even better reason to buy it...it grows with you. Needs change, your single user system may expand to multi-user, new requirements need to use valuable information developed in present applications. DataFlex will never keep you down!

DataFlex...available in single user and multi-user versions for 8 and 16 bit systems with extensive support for local area networks.

Get into orbit now with DataFlex.
The applications environment of the '80's.

DATAACCESS
CORPORATION

8525 S.W. 129th Terrace, Miami, FL 33156
(305) 238-0012 TLX 469021 Data Access CI

See us at
COMDEX/Fall '83
November 28-December 2, 1983
Las Vegas Convention Center
Las Vegas, Nevada

CIRCLE 215 ON READER SERVICE CARD

Letters continued . . .

06070. DIMS isn't very useful on a single-density Osborne because of the size of the program and the storage limitation. I've thought about fixing a version that doesn't use backup for the Osborne, but can't give it a high enough priority to get done here. Hope someone else does.

I am presently (in my spare time, I'm a free-lance sound consultant) writing a structured DBMS for the Radio Shack Model 100.

Dan Dugan

Update to version 1.01

(October 17, 1982)

To: All users of DIMS version 1.0
Bug fix in "select" command. Whenever the question "Do you want to select records to exclude" is answered "y," the first exclusion specification will not be cleared, and will remain in effect in all subsequent selections until the program is restarted from Basic. This results in skipping wanted records in later operations. The fix is just one character in one line in "DEDIT.BAS:"

Old line:

```
7660 IF AS<>"y" THEN
      SKIPWORDS(1)="":RETURN
```

Replace with new line:

```
7660 IF AS<>"y" THEN
      SKIPWORDS(0)="":RETURN
```

Sorry for the trouble. Since the "SETSEARCH" subroutine only happens in DEDIT, fixing this line will fix the whole system. Implementing this fix updates DIMS to version 1.01.

Update to version 1.02

Enhancement to allow selecting records with a blank field. This improvement requires changing code not only in DEDIT but also in all the transient programs that use record selection. The cost of this change is a 3.5% decrease in record selection speed and a very small increase in program size.

When the "select" command asks for an expression, entering the un-

derline character "____" alone will select records that are blank (no data at all) in the specified field.

Add the following two lines to DEDIT.BAS:

```
3165 IF BS(LOOKFIELD(J))="" AND
      SKIPWORDS(J)="" THEN
      5770 'blank field
3265 IF BS(SEARCHFIELD(J))=""
      AND SEARCHWORDS(J)=""
      THEN 3290
```

Add two similar lines to the following programs (the number after "then" will change):

DLABELS	1395	1495
DLETTERS	1475	1575
DSTAT	1435	1535
DPUT	5255	5355

While doing this I found that the built-in editor in Basic-80 5.2 goofs up if you use "____" in edit mode. Just type the line as a new line.

Dan Dugan Sound Design
833 14th St.
San Francisco, CA 94114
(415) 621-0781

INTERSTELLAR DRIVE™

A SOLID STATE DISK EMULATOR



Save valuable time!
5 to 50 times faster
performance than floppy disks
and Winchester drives

PION'S INTERSTELLAR DRIVE is designed for use with a family of interfaces and software packages. Currently available are interfaces for IBM, S100, TRS80, Apple, SS50, and most Z80 uP, and software for most popular operating systems. Additional interfaces are continually being developed for the most popular computers.

SAVE MONEY!
Increase your
computer's productivity

The INTERSTELLAR DRIVE is a high performance data storage subsystem with independent power supply, battery backup, and error detection. It has 256KB to 1 Megabyte of solid state memory integrated to perform with your operating system.

Basic Price for 256KB unit [Includes interface and software]

\$1095. plus tax (where applicable) and shipping

Visa and Master Card accepted.



PION, INC.

Tel. (617) 923-8009

101R Walnut St., Watertown, MA 02172

TRS80 trademark of Tandy Corp. Apple trademark of Apple Computers
Interstellar Drive trademark of PION, Inc.

CIRCLE 175 ON READER SERVICE CARD

The New 16-Bit Super Microcomputers

**A comparative look at the Intel 80286,
Motorola 68000, and National 16032**

by William G. Wong

The new collection of super microcomputers provides a major architectural improvement over the existing 8- and 16-bit microcomputer chips such as the 8080, Z80, and 8086. The architectures of three new super microcomputer chips are presented in this article. These include the iAPX 80286 from Intel, the 68000 family from Motorola, and the National Semiconductor 16032. The main features found in these new architectures include:

1. Faster execution
2. Enhanced instruction sets
3. Hardware multitasking support
4. Improved debugging capabilities
5. Large address space (usually 16 MB)
6. Virtual memory support (greater than 16 MB/task)
7. Instruction and data cache
8. Floating-point hardware

More details in areas such as individual instruction operation can be found in the various manuals available from the manufacturers listed at the end of the article. The architectures of the 80286, the 68000, and the 16032 will be considered individually, since they are all quite different. The summary will deal only with a superficial comparison of the three, since any actual implementation using any of these chips depends heavily on the intended use and product line of the company designing a new computer. Newer chips not covered in this article, but within the same class, include the Zilog Z8000 and Z80000, the Intel 432, and the DEC LSI-11 series.

The three microprocessors reviewed cover both the 16- and 32-bit world. The 80286 is a 16-bit processor, while the 68000 and 16032 are 32-bit processors. The following presentation shows why all three are within the same class of super microcomputers.

Intel iAPX 80286

The Intel iAPX 80286 is really a greatly improved version of the very popular Intel 8086 family. In fact, the 80286 actually has two operating modes. One is the 8086 mode, which provides a fully compatible 8086 environment, including the 1 MB memory limit. The advantage over the 8086 is speed: The 80286 native mode is more powerful and increases the memory limit to 16 MB. There are quite a number of additional enhancements, which are addressed in the remaining part of this section.

Figure 1 shows a block diagram of an 80286 system. It includes the optional 80287 numeric processing unit (NPU) which provides IEEE-compatible floating-point support in the same fashion as the 8087 NPU does for the

8086. The 80286 includes two queues for instruction pipelining, which increases execution speed. The prefetch queue simply does a look-ahead from the instruction pointer and retrieves up to 8 bytes of code; the other queue contains decoded instructions that have been converted into internal microcode from the prefetch queue code. The 1 gigabyte logical memory limit is discussed later.

Figure 2 shows the programmer's model of the 80286. Note that the visible register set is identical to that of the 8086. The invisible portion is used in the native mode operation. The key additions to the 8086 architecture are in the invisible portion used in the native mode operation. The key additions to the 8086 architecture are in the invisible portion of the 80286 model. This is also where the virtual memory and multitasking support are provided.

The 80286, like the 8086, is a segmented memory machine where memory is viewed as a number of segments which, in this case, are smaller than the logical address space. The segment size for both the 8086 and 80286 is limited to 64K. Four segment registers (CS, DS, SS, ES) are provided, and all memory accesses use one of these registers to reference physical memory. The native mode operation also has a program-invisible segment descriptor register paired with each of the segment register.

The segment descriptor register contains the physical base address within the 16 MB physical memory along with the size of the segment, which is up to 64K. Access rights are also contained in the descriptor register, which indicate whether the segment is read only, executable, resident, and so on. These access rights and limit values allow an operating system to restrict the use of segments by programs and provide the virtual memory support required in the super microcomputer environment.

Since the segment descriptor registers are invisible to the program, the 80286 must take care of their contents. In fact, the 80286 does this on a demand basis, using the Global Descriptor Table (GDT) and the Local Descriptor Table (LDT) registers. These registers also contain segment descriptors whose segments contain segment descriptors, whereas the CS, DS, SS, and ES segment descriptors reference program code and data. The value in the visible segment registers is actually an index into either the GDT or the LDT. When a segment register is first used for a memory reference, the 80286 checks the appropriate descriptor table and loads the invisible portion of the segment register with the segment descriptor located in the table. Changing the contents of a segment register will cause the local copy of the memory segment descriptor to be marked invalid, thereby requiring a subsequent descriptor table reference if the segment register is used again.

The Interrupt Descriptor Table (IDT) register is used in the same fashion, except that an interrupt vector is used to

William G. Wong, 902B Merritt Drive, Somerville, NJ 08876

index the table. The other difference is that the IDT contains special task segment descriptors that are loaded into the Task State Segment (TSS) register. This process is actually a hardware-supported task switch mechanism, which is the basis for the hardware multitasking support provided by the 80286. This support and its operation are discussed in more detail later.

Figure 3 shows how the 80286 uses the segment descriptor registers to reference main memory. A process can access only four 64K segments at any one time, as in the 8086. However, the segment registers can index 8K segment descriptors in the GDT or the LDT; thus a program

can have indirect access to 1 gigabyte of memory, provided that all segments are 64K in size. The number of processes is limited only by the operating system implementation.

Figure 4a shows the selector format for values loaded into the visible segment registers. The use of the index and table fields have been described. The Requested Privilege Level (RPL) field provides an additional protection mechanism that is combined with other privilege level indicators within the 80286 architecture. Each process (also called a task) operates at one of four privilege levels shown in Figure 4b. The Kernel is the most privileged process and has access to all memory segments, invisible segment regis-

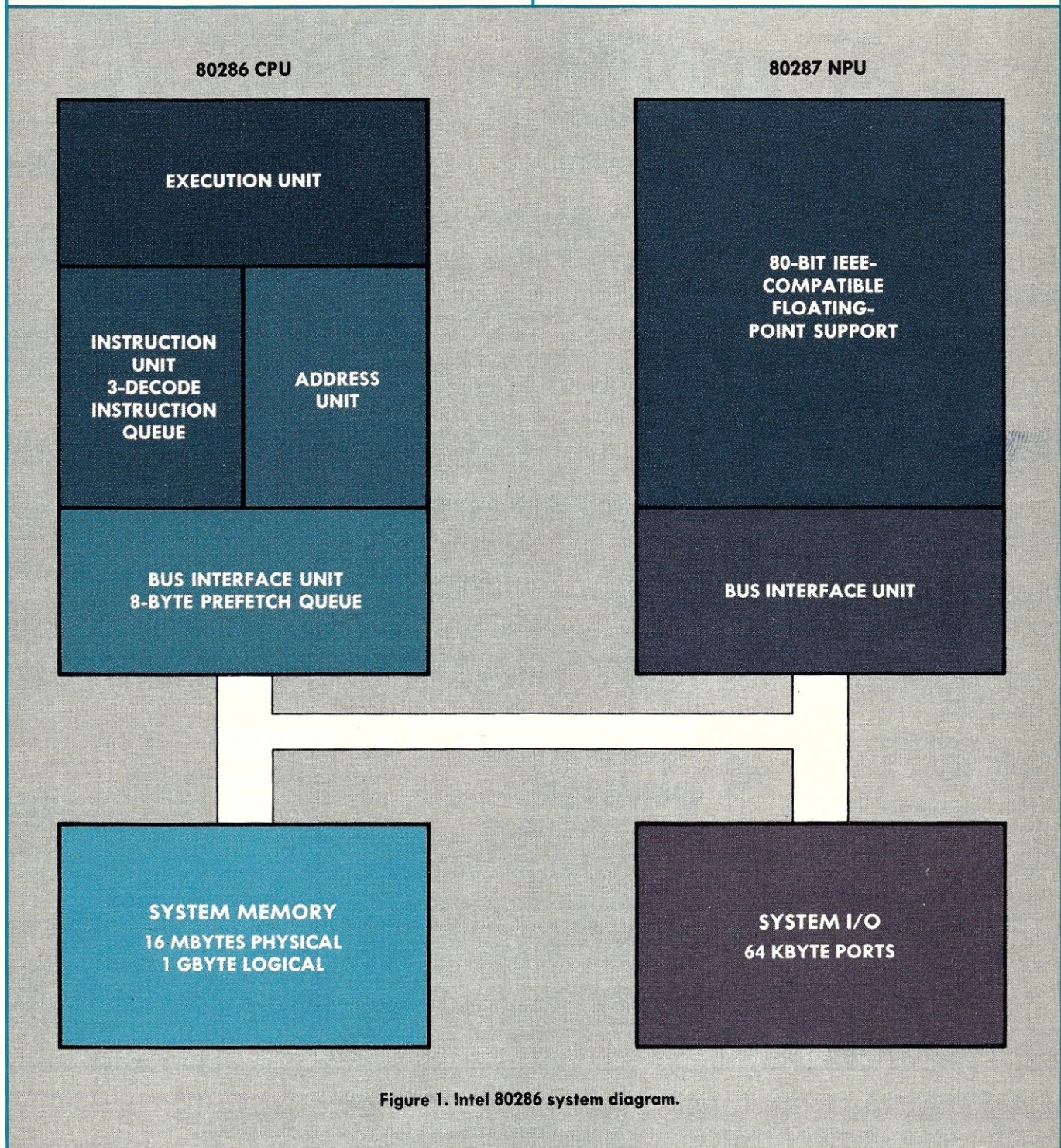


Figure 1. Intel 80286 system diagram.

64K Static Ram



8-inch Sub-system



A & T with
2 Siemens drives

Siemens 8-inch



JADE

Computer Products

PRICE

8-inch Slimline Sub-systems

Dual Slimline Sub-systems - JADE

Handsome vertical cabinet with scratch resistant baked enamel finish, proportionally balanced air flow system, quiet cooling fan, rugged dual drive power supply, power cables, power switch, line cord, fuse holder, cooling fan, all necessary hardware to mount two 8 inch slimline disk drives. Does not include signal cable

Dual 8 inch Slimline Cabinet

END-000820 Bare cabinet	\$59.95
END-000822 A & T w/o drives	\$164.95

Dual 8 inch Slimline Sub-systems

END-000843 Kit w/2 SS DD drives	\$869.00
END-000844 A & T w/2 SS DD drives	\$879.00
END-000845 Kit w/2 DS DD drives	\$1060.00
END-000846 A & T w/2 DS DD drives	\$1099.00

Dual Disk Sub-systems

Disk Sub-systems - JADE

Handsome metal cabinet with proportionally balanced air flow system, rugged dual drive power cable kit, power switch, line cord, fuse holder, cooling fan, nevermar rubber feet, all necessary hardware to mount two 8 inch disk drives, power supply, and fan, does not include signal cable

Dual 8" Sub-Assembly Cabinet

END-000420 Bare cabinet	\$49.95
END-000421 Cabinet kit	\$199.95
END-000431 A & T	\$249.95

8" Sub-Systems—Single Sided, Double Density

END-000423 Kit w/2 Siemens FD100-8Ds	\$579.00
END-000423 A & T w/2 Siemens FD100-8Ds	\$595.00
END-000433 Kit w/2 Shugart SA-801Rs	\$939.00
END-000434 A & T w/2 Shugart SA-801Rs	\$969.00

8" Sub-Systems—Double Sided, Double Density

END-000426 Kit w/2 Qume DT-8s	\$1229.00
END-000427 A & T w/2 Qume D-8s	\$1249.00
END-000436 Kit w/2 Shugart SA-851 Rs	\$1199.00
END-000434 A & T w/2 Shugart SA-851 Rs	\$1219.00

Disk Drive Power Supply

Sufficient current to power up to three 8-inch disk drives

PART NO	DESCRIPTION	1-9	10-24	24-99
PSD-206A	8" power supply	89.95	79.95	69.95

8-inch Disk Drives

Siemens FDD 100-8 Single sided, double density	
MSF-201120	\$179.00 ea 2 for \$175.00 ea
Shugart SA 801R Single sided, double density	
MSF-10801R	\$355.00 ea 2 for \$349.00 ea
Shugart SA-10851R Double sided, double density	
MSF-10851R	\$459.00 ea 2 for \$455.00 ea
Qume DT-8 Double sided, double density	
MSF-750080	\$479.00 ea 2 for \$459.00 ea
Tandon TM 848-1 Single sided, double density thin-line	
MSF-558481	\$369.00 ea 2 for \$359.00 ea
Tandon TM 848-2 Double sided, double density thin-line	
MSF-558482	\$439.00 ea 2 for \$435.00 ea
NEC FD1165 Double sided, double density thin-line	
MSF-851165	\$450.00 ea 2 for \$440.00 ea

5 1/4-inch Disk Drives

Tandon TM 100-1 Single sided, double density 48 TPI	
MSM-551001	\$225.00 ea 2 for \$195.00 ea
Shugart SA 400L Single sided, double density 40 track	
MSM-104000	\$209.00 ea 2 for \$199.95 ea
Tandon TM 100-2 Double sided, double density 48 TPI	
MSM-551002	\$229.00 ea 2 for \$225.00 ea
MPI B52 Double sided, double density, 48 TPI can be substituted for CDC	
MSM-155200	\$275.00 ea 2 for \$270.00 ea
MPI B51 Single sided, double density 48 TPI	
MSM-155100	\$209.00 ea 2 for \$199.00 ea

5 1/4 inch Cabinets with Power Supply

END-000216 Signal cab w/power supply	\$69.95
END-000226 Dual cab w/power supply	\$85.00

DISKETTES

VERBATUM DATALIFE

Critical ANSI certification diskettes. Warranted for 5 years, hub rings standard on minidiskettes. All tracks certified on 8-inch diskettes; full surface certified on 5 1/4 inch diskettes

5 1/4" (packaged w/plastic storage box & hub ring)

MMD-5120101 SS DD soft sector	\$35.00
MMD-5220101 DS DD soft sector	\$47.00
MMD-5140101 SS QD soft sector	\$46.50
MMD-5240101 DS QD soft sector	\$59.95

8" (soft box, no hub ring)

MMD-8110101 SS SD soft sector	\$39.95
MMD-8120101 SS DD soft sector	\$46.00
MMD-8220101 DS DD soft sector	\$57.00

Available only in boxes of 10

64 Static Ram - JADE

Uses new 2K x 8 static RAMs, fully supports IEEE 696 24 bit extended addressing, 200ns RAMs, lower 32K or entire board phantomable, 2716 EPROMs may be subbed for RAMs, any 2K segment of upper 8K may be disabled, low power typically less than 500ma

MEM-99152B Bare board	\$49.95
MEM-99152K Kit less RAM	\$89.95
MEM-32152K 32K kit	\$169.00
MEM-56152K 56K kit	\$225.00
MEM-64152K 64K kit	\$265.00
Assembled & Tested	add \$30.00

EXPANDORAM III

SD Systems new ExpandoRAM III is a high density S-100 memory board utilizing the new 64K x 1 dynamic RAM chips. It allows memory sizes of 64K, 128K or 256K all on a single S-100 board.

MEM-65064A 64K	\$398.95
MEM-65128A 128K	\$464.95
MEM-65192A 192K	\$524.95
MEM-65256A 256K	\$598.95

ExpandoRAM IV - SD Systems

State-of-the-Art; full compliance with IEEE 696, 256K using 64K RAM chips. Up to 1024K using 256K RAM chips, parity check, error detection and correction optional. Supports both 8 and 16 bit data transfers. One year factory warranty

MEM-66256 ExpandoRAM IV w/parity	\$975.95
MEM-67256 ExpandoRAM IV w/EDC	\$1675.95

MODEMS

SIGNALMAN MODEMS

1200 and/or 300 baud, direct connect, automatic answer or originate selection, auto-answer/auto-dial on deluxe models. 9v battery allows total portability, full one year warranty

IOM-5600A 300 baud direct connect	\$89.95
IOM-5620A 1200/300 baud Deluxe	\$369.95

SMARTMODEM—HAYES

Sophisticated direct-connect auto-answer/auto-dial modem, touch-tone or pulse dialing, RS-232C interface programmable

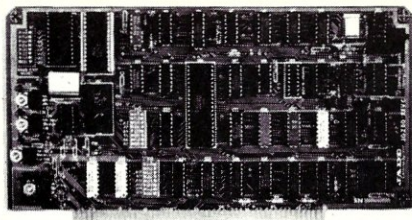
IOM-5500A Smartmodem 1200	\$475.00
IOM-5400A Smartmodem 300	\$199.00
IOK-1500A Hayes Cronograph	\$199.00
IOM-1100A Micromodem 100	\$349.00
IOM-2010A Micromodem II	\$259.00

We accept cash, checks, credit cards, or purchase orders from qualified firms and institutions.

Minimum prepaid order \$15.00 California residents add 6 1/2% tax. Export customers outside the US or Canada please add 10% to all prices. **Prices and availability subject to change without notice.** Shipping and handling charges via UPS Ground 50¢/lb. UPS Air \$1.00/lb. **minimum charge \$3.00**

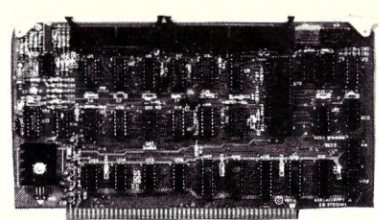
Satisfying Your Personal And Professional Computer Needs Since 1975

The Big Z



The Bus Probe

Versafloppy II



BREAKTHROUGH!

S-100 I/O Boards

The Bus Probe

Inexpensive S-100 diagnostic analyzer

TSX-200B Bare board	\$59.95
TSX-200K Kit	\$179.95
TSX-200A A & T	\$199.95

I/O-4 - SSM MICROCOMPUTER

Two serial I/O ports plus two parallel I/O ports

IOI-1010A A & T	\$245.00
-----------------	----------

I/O-5 - SSM MICROCOMPUTER

Two serial & three parallel ports, 110-19.2K baud

IOI-1015A A & T	\$289.00
-----------------	----------

Interfacer 4 - COMPUPRO

Three serial, one parallel, one centronics parallel

IOI-1840A A & T	\$389.95
IOI-1830C CSC	\$495.00

I/O-8 - SD Systems

Full compliance with IEEE 696 standards, operates as a Bus Slave. Available with 8 Async ports or 4 Async and 4 Async ports, up to 1 Megabit/sec in synchronous mode. Real time clock with battery back-up. One year factory warranty

IOI-1510A 8 Async ports	\$589.95
IOI-1520A 4 Sync/4 Async	\$669.95

Eprom Erasers

Ultra-violet Eprom Erasers

Inexpensive erasers for industry or home

XME-3100 Spectronics w/o timer	\$69.50
XME-3100 Spectronics with timer	\$94.95
XME-3200 Logical Devices	\$49.95

S-100 Eprom Boards

PB-1 - SSM MICROCOMPUTER

2708, 2716 EPROM board with on-board programmer

MEM-99510K Kit w/manual	\$154.95
MEM-99510A A & T w/manual	\$219.00

Prom-100 - SD Systems

2708, 2716, 2732 EPROM programmer with software

MEM-99520A A & T with software	\$219.95
--------------------------------	----------

S-100 CPU Boards

The BIG Z — Jade

2 or 4 MHz switachable Z-80 CPU board with serial I/O accommodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600.

CPU-30200B Bare board w/manual	\$35.00
CPU-30201K Kit w/manual	\$179.00
CPU-30201A A & T	\$199.00

SBC-200 - SD Systems

4 MHz Z-80A CPU with serial & parallel I/O, 1K RAM, 8K ROM space, monitor PROM included.

CPC-30200A A & T	\$298.95
------------------	----------

CPU-Z - COMPUPRO

2 or 4 MHz Z80A cpu, 24 bit addressing

CPU-30500A 2/4 MHz A & T	\$279.95
CPU-30500C 3/6 MHz CSC	\$374.95

8085/8088 - COMPUPRO

Both 8 & 16 bit CPUs standard 8 bit S-100 bus, up to 8 MHz, accesses 16 MegaBytes of memory

CPU-20510A 6 MHz A & T	\$389.95
CPU-20510C 6/8 MHz CSC	\$497.95

SBC 300 - SD Systems

Self-contained S-100 Z80 microcomputer, 4/6 MHz, 64K RAM with parity; 2 to 16K of PROM, 24 bit addressing, fully complies with IEEE 696 standards. It can function as a permanent Bus Master or as Slave. Two fully programmable serial channels with handshaking; full SASI format. One year factory warranty

CPC-30304A SBC 300, 4 MHz, A & T	\$619.95
CPC-30306A SBC 300, 6 MHz, A & T	\$689.95

S-100 Motherboards

ISO Bus - JADE

Silent, simple and on sale—a better motherboard

6 Slot (5 1/4" x 8 5/8")	
MBS-061B Bare board	\$22.95
MBS-061K Kit	\$39.95
MBS-061A A & T	\$49.95

12 Slot (9 3/4" x 8 5/8")	
MBS-121B Bare board	\$34.95
MBS-121K Kit	\$69.95
MBS-121A A & T	\$89.95

10 Slot (14 1/2" x 8 5/8")	
MBS-181B Bare board	\$54.95
MBS-181K Kit	\$99.95
MBS-181A A & T	\$139.95

S-100 Disk Controllers

VERSAFLOPPY II - SD Systems

Double density disk controller for any combination of 5 1/4" and 8" single or double sided, analog phase-locked loop data separator, vectored interrupts. CP/M 2.2 & Oasis compatible control/diagnostic software PROM included.

IOD-1160A A & T with Prom	\$344.95
SFC-55009047F CP/M 3.0 with VF-II	\$80.00

2422 Disk Controller - CCS

5 1/4" or 8" double density disk controller with on-board boot loader ROM, FREE! CP/M 2.2 & manual set

IOD-1300A A & T with CP/M 2.2	\$338.00
-------------------------------	----------

Double D - JADE

High reliability double density disk controller with on-board Z-80A, auxiliary printer port, IEEE S-100 can function in multi-user interrupt driven bus

IOD-1200B Bare board & h/wr man	\$59.95
IOD-1200K Kit w/h/wr & s/wr man	\$299.95
IOD-1200A A & T w/h/wr & s/wr man	\$325.00
SFC-59002001F CP/M 2.2 with Double D	\$99.95

Versafloppy II/696 - SD Systems

Fully compatible with IEEE 696 standards, phase-locked loop data separator, CRC error checking. Reads/writes IBM 3740 and system 34 formats, concurrent support of any combination of 4 5 1/4" or 8" drives. Single or double sided drives supported; single or double density. One year factory warranty

IOD-1170A Versafloppy II/696 A & T	\$349.95
SFC-55009157F 8" banked CP/M 3.0*	**\$75.00
SFC-55009157M 5 1/4" banked CP/M 3.0*	**\$75.00
SFC-55009159F 8" unbanked CP/M 3.0*	**\$75.00
SFC-55009159M 5 1/4" unbanked CP/M 3.0*	**\$75.00

*configured for Versafloppy II/696 & SBC 300

**price \$75.00 if ordered with Versafloppy II, price if ordered separately if \$199.95

Versafloppy III - SD Systems

Winchester and floppy controller in a single board! Full compliance with IEEE 696 standards, controls up to three floppy drives and three 5 1/4" Winchester drives. Data may be transferred under DMA or programmed I/O control. One year factory warranty

IOD-1180A Versafloppy III A & T	\$759.95
SFC-55009257F 8" banked CP/M 3.0*	**\$129.00
SFC-55009257M 5 1/4" banked CP/M 3.0*	**\$129.00
SFC-55009259F 8" unbanked CP/M 3.0*	**\$129.00
SFC-55009259M 5 1/4" unbanked CP/M 3.0*	**\$129.00

*configured for Versafloppy III & SBC 300

**price \$129.00 if ordered with Versafloppy III, price if ordered separately if \$199.95

Place Orders Toll Free!

Continental U.S.A.
(800) 421-5500

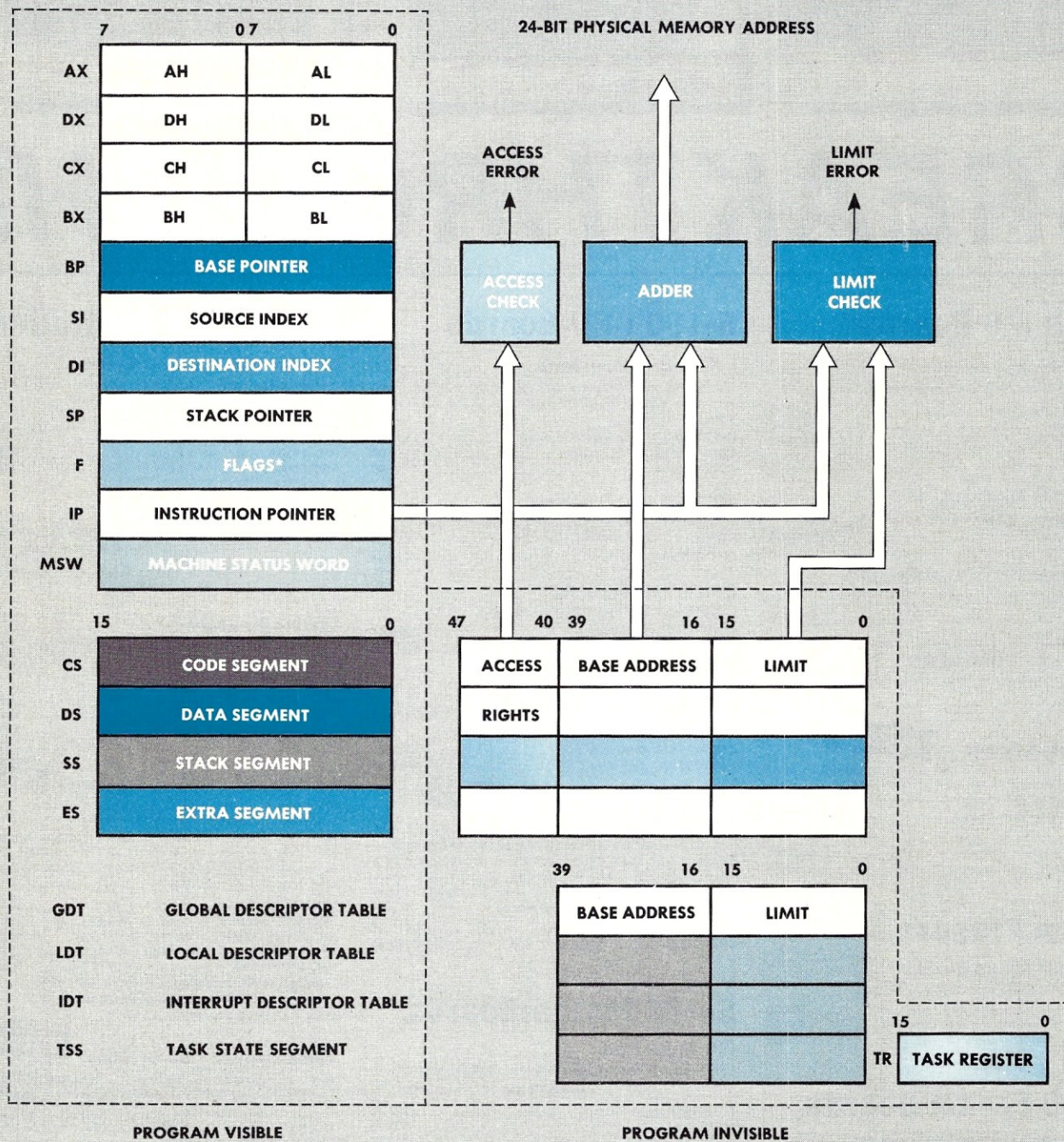
Inside California
(800) 262-1710

Los Angeles Area
(213) 973-7707

4901 West Rosecrans Ave., Hawthorne, California 90250

CIRCLE 29 ON READER SERVICE CARD

16-Bit Super Micros continued . . .



*Flags Bits:

- | | | | |
|------------|-------------------|--------------------|------------------------|
| 0 CARRY | 4 AUXILIARY CARRY | 8 TRAP ENABLE | 12 I/O PRIVILEGE LEVEL |
| 1 RESERVED | 5 RESERVED | 9 INTERRUPT ENABLE | 13 RESERVED |
| 2 PARITY | 6 ZERO | 10 DIRECTION | 14 NESTED TASK |
| 3 RESERVED | 7 SIGN | 11 OVERFLOW | 15 RESERVED |

Figure 2. Intel 80286 CPU block diagram.

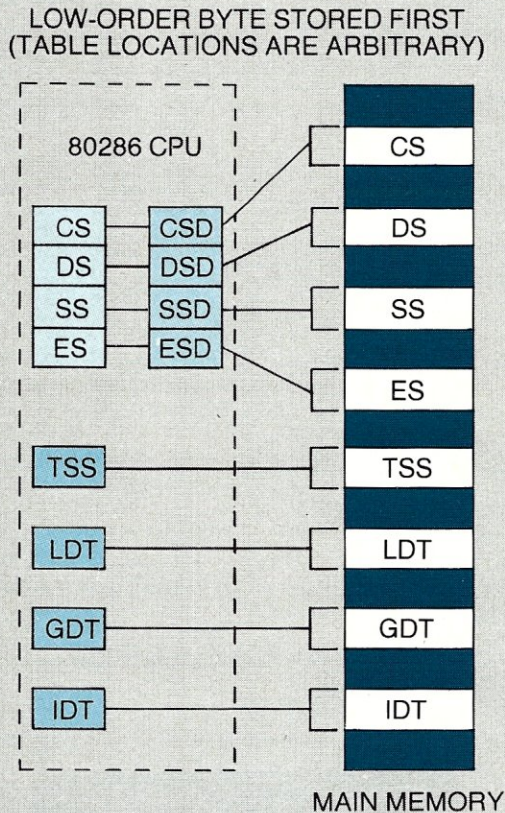


Figure 3. Intel 80286 memory map.

ters, and all I/O. The Kernel is always imbedded in the operating system. Application processes, on the other hand, are the most restricted and must request the operating system to perform control operations such as I/O. This hardware privilege level support is needed to provide security in a multitasking environment.

Figure 4c shows the general format for a descriptor contained in a table referenced by the GDT, LDT or IDT. The reserved section must be zero for compatibility with future Intel super microcomputers such as the iAPX 80386. The descriptor information is dependent upon the contents of the type field; however, the field to notice at this time is the Descriptor Privilege Level (DPL). This is also tied in with the privilege level of the current 80286 and each of the selectors. In general, the DPL value is used to control access to segments indexed through the GDT, since this does not usually change when different processes run. System services could thereby access segments when called from different processes, but a normal application could not use this privileged information.

Figure 5 shows the format for different descriptor types which are referenced by the GDT, LDT and IDT. The code and data descriptor format in Figure 5a shows how the contents of the descriptor match those of the invisible segment descriptor registers in the 80286. The base and limit fields describe the segment location and size within the 16 MB of physical memory, while the remaining bits contain the access of rights. The Present and Accessed bits are used for virtual memory support. An interrupt occurs if a referenced segment is not present, and the accessed bit is updated in the appropriate GDT or LDT table entry when a segment is referenced.

Figure 5b shows a gate descriptor whose operation may be new to many people. Gates are accessed by a long call or

Intel 80286 Privilege Control

Selector:



T—TABLE TO BE ACCESSED (0—GDT, 1—LDT)
RPL—REQUESTED PRIVILEGE LEVEL (0-3)

Figure 4A. selector format.

The Intel iAPX 80286 is really a greatly improved version of the very popular Intel 8086 family. The 80286 native mode is more powerful and increases the memory limit to 16 MB, and there are quite a number of enhancements.

Intel 80286 Privilege Control

Privilege Level		Restrictions	Access
0	KERNEL	NONE	0,1,2,3
1	SYSTEM SERVICES		1,2,3
2	OS EXTENSIONS		2,3
3	APPLICATIONS	MOST	3

Figure 4B. The four privilege levels.

jump through the GDT or LDT segments or an interrupt through the IDT segment. The difference occurs when the segment accessed contains a gate descriptor instead of a code segment descriptor. A gate allows two things to occur. The first is that the privilege level of a process can change in a controlled fashion and, optionally, a coroutine style task switch can occur. The original privilege level is restored when the referenced routine returns.

Figure 5c describes the system segment descriptor. This can be loaded into the TSS register only in response to a task switch operation via a gate segment descriptor. In this case, the current process state is saved in a segment like that shown in Figure 5d. The new process state is loaded from a similar segment referenced by the new system segment descriptor, which is then loaded in the TSS register.

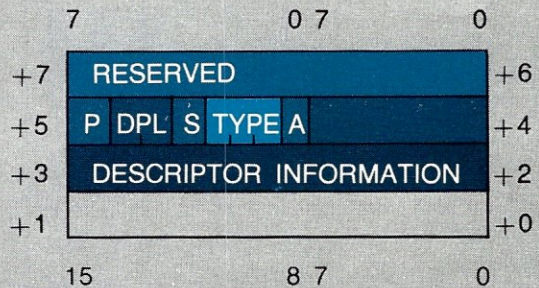
The 80286 also provides a number of new instructions that are primarily for access to the invisible registers, such as the LDT and GDT, while in the Kernel privilege mode. This, combined with the hardware support for multi-tasking, virtual memory, and floating point definitely make the 80286 a super microcomputer. A fairly compatible superset of the 8086 instruction set makes it a formidable chip. Programmers using the 8086 should keep in mind that the values placed into the visible segment registers should be used carefully if programs are to be moved to the 80286 without any change. This upgrade path is one of the best features of the 80286.

Motorola 68000

The M68000 family contains a number of code-compatible processors, some of which (like the 68010) provide virtual memory support. Internally, each member of the 68000

Intel 80286 Privilege Control

Segment Descriptors:



DPL—DESCRIPTOR PRIVILEGE LEVEL

Figure 4C. General format for a descriptor.

family is a 32-bit microprocessor with an orthogonal instruction set; most of the registers are fully general purpose, so a programmer can use them without having to worry about special instructions that use particular registers. Figure 6 shows a system diagram of a 68000 with virtual memory support provided by one or more separate 68451 Memory Management Units (MMU). This differs from the on-chip support provided by the 80286. The 68000/68451 provides a 16 MB physical address space and a 16 MB logical address space per process. I/O is memory mapped and thus forms part of the physical address space.

Internally, each member of the 68000 family is a 32-bit microprocessor with an orthogonal instruction set. Most of the registers are fully general purpose, so the programmer can use them without worrying about special instructions that use specific registers.

THE UNKNOWN GIANT

The SMALL ONE is a highly sophisticated dependable portable computer designed for the professional. It provides versatility through **S-100** hardware and compatibility with **CP-M** software. Typical system uses include:

- Program Development
- Video Image Processing
- Computer Aided Design (CAD)
- Spreadsheet and Word Processing
- Automated Testing and Instrument Control
- Adaptive Educational Testing



GMR
INCORPORATED

1048 E. Burgrove St.
Carson, Calif. 90746
(213) 639-4663

Boston
Massachusetts
TLX 4992468

London
United Kingdom
TLX 86554

Lucerne
Switzerland
TLX 56940

© title
1983 YUMA GAMES
U.S. Patents
4294496 &
DES 263586

Intel 80286 Segment Descriptors

Code and Data Descriptors:

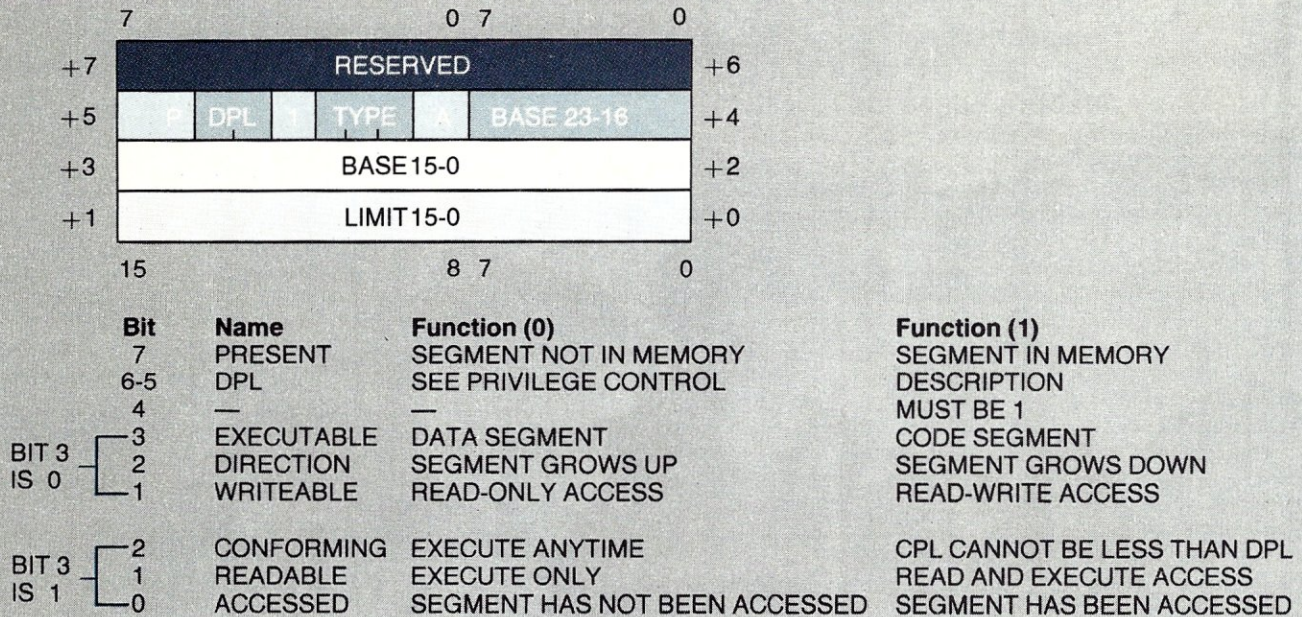


Figure 5A. Code and data descriptor format.

This reduces the instruction set complexity, since there are no special instructions for supporting peripheral interfaces. The MMU is the exception to the rule because there are special instructions for accessing this device. By design, such operations are normally restricted to the operating system, so application programs would not require their use.

Figure 7 shows the programmer's model of the 68000, which is the same for each chip. It has a very simple and regular architecture, and the 32-bit registers allow a program to have direct access to the entire 16-MB address space. The address is actually 24 bits in length, allowing growth for future chips such as the 68020.

The 68000 provides limited multiprocessing support along the lines of conventional microprocessors. It does have two privilege levels, user and supervisor, along with a separate stack pointer for each level. Unlike the 80286, the 68000 must do a task switch in software. The task switch is complicated due to the interaction with the 68451 MMU shown in Figure 8. The task state number must be changed in each MMU in addition to changing all the 68000 registers when a task switch occurs.

Each process usually operates in a different logical address space controlled by the MMU. The MMU accepts logical memory address and converts them into physical memory addresses, which are then sent to physical memory. The MMU operates in a paged/segment mode where the pages are 256 bytes and the segments are some number of pages. The page index is used to access a form of content-addressable memory in each MMU containing segment descriptors similar to those of the 80286. The selected segment descriptor supplies the physical page index. An interrupt occurs if only one segment descriptor is not selected.

The MMU is a very complex device that is equally complex in its programming. Each process is given a number that is placed into the address state table when the process is active. This table is accessed for each memory reference depending upon the current state of the 68000. The table also contains the supervisor process number, which is compared against address space number in each segment descriptor. A segment descriptor is selected when the address space and logical address match. A mask is provided for each of these to allow segment descriptors to be shared

The 68000 family presents a very simple and regular architecture to the programmer, since MMU control is performed by the operating system. The clean processor model and large linear address space make the 68000 similar to many large mainframes.

All you dBASE II™ hotshots are about to get what you deserve.

You've written all those slick dBASE II programs.

Business and personal programs. Scientific and educational applications. Packages for just about every conceivable information handling need.

And everybody who sees them loves them because they're so powerful, friendly and easy to use.

But that's just not good enough.

Uh-uh.

Because now you can get the gold and the glory that you really deserve.

Here's how.

We've just released our dBASE II RunTime™ application development module.

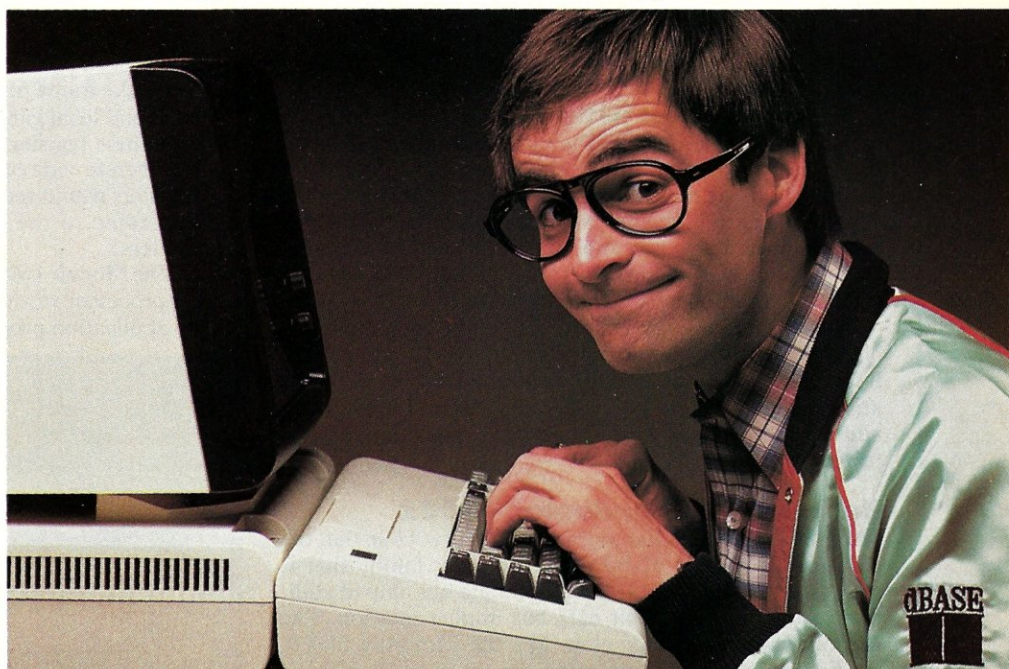
And it can turn you into an instant software publisher.

The RunTime module condenses and encodes your source files, protecting your special insights and techniques, so you can sell your code without giving the show away.

RunTime also protects your margins and improves your price position in the marketplace. If your client has dBASE II, all he needs is your encoded application. If not, all you need to install your application is the much less expensive RunTime module.

We'll tell the world.

With your license for the dBASE II RunTime module, we provide labels that identify your program as a dBASE II application, and you get the benefit of all the dBASE II marketing efforts.



We'll also provide additional "how to" information to get you off and running as a software publisher sooner.

And we'll make your products part of our Marketing Referral Service. Besides putting you on our referral hotline, we'll publish your program descriptions and contact information in *dBASE II Applied*, a directory now in computer stores world-wide.

Go for it.

But we can't do any of this until we hear from you.

For details, write RunTime Applications Development, Ashton-Tate, 10150 West Jefferson Boulevard, Culver City, CA 90230.

Or better yet, just call (213) 204-5570. And get what you deserve today.



ASHTON-TATE

by a number of different tasks.

Loading the segment descriptors is done under program control, using special instructions to access the accumulator registers in each MMU. A system can have one or more MMUs. Some operations access all MMUs at once; other instructions access one MMU at a time. The control registers in the MMU are used to determine memory access conflicts.

Figure 9 shows that the 68000 memory map is much simpler than that of the 80286; however, the interrupt vectors must be placed at the bottom of the physical memory. Actually, this is not a problem, given the memory mapping scheme, since application programs can have this logical area mapped to some other physical area in memory, thereby allowing only the operating system to update the interrupt vectors in a controlled fashion.

The 68000 family presents a very simple and regular architecture to the programmer, since the MMU control and interrupt control are normally performed only by the operating system. The clean processor model and large linear address space make the 68000 similar to many large main-frame computers.

National Semiconductor 16032

The NSC16032 is similar to the Motorola 68000 in that the NSC16032 is also a 32-bit microcomputer family that is supposed to include an 8- and 32-bit data bus chip in addition to the original 16-bit data bus implementation. The National Semiconductor chip, like the Motorola 68000, provides an orthogonal instruction space and a large linear access space. The 16032 system diagram (Figure 10) is very similar to that of the Motorola chip, but the 16032 contains a number of significant features.

The first is the 8-byte instruction prefetch queue in the main processor, which is the 16032 chip. This helps increase execution speed for many programs. There is also an IEEE-compatible floating-point processor chip called the 16081 Floating Point Unit (FPU) which, amazingly, fits into a standard 24-pin dual inline package (DIP) instead of the 40-pin DIPs normally associated with super microcomputer floating-point units. The 16082 MMU fits into a larger 48-pin DIP and provides the programmer with a large, linear, paged virtual address memory similar to that of the 68000; however, only one 16082 MMU is ever needed, regardless of configuration, which simplifies hardware design. The MMU is discussed later in more detail.

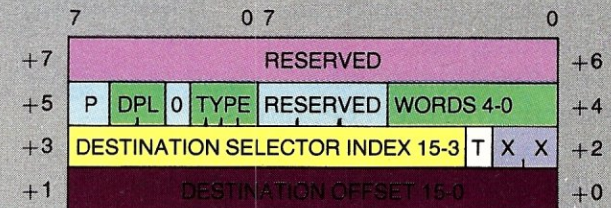
The 16081 FPU contains eight general-purpose floating-point registers, similar to the eight general-purpose registers in the main CPU, as shown in Figure 11. The symmetric register set is combined with an orthogonal instruction set to produce a very complete execution environment. A number of special registers are included to improve this environment.

The first is the Interrupt Base (INTBASE) register, which points to the base of the interrupt vector table. This

allows the table to be placed anywhere in memory, as with the 80286, instead of being limited to a fixed location as with the 68000. The Static Base (SB), Frame Pointer (FP), and stack registers (SP0 and SP1) are used to provide a conventional stack architecture that facilitates the implementation of lexical languages such as Algol, C and Pascal. The static base (SB) points to the base of the global variable table; the frame pointer (FP) references procedure parameters and local variables. The instruction set is designed to take these registers into account, thus allowing compilers to generate code easily and efficiently. Elimination of these registers would require two or more general registers to be dedicated to the same purpose, thereby complicating matters.

The Module (MOD) register is a new addition to the microprocessor world. It assists in the use of system modules by application programs. Mathematical subroutine library

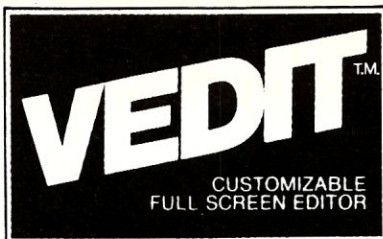
Intel 80286 Segment Descriptors
Gate Descriptors:



Field Name	Description
PRESENT	0—CONTENTS NOT VALID 1—CONTENTS VALID
TYPE	(SEE SYSTEM SEGMENT DESCRIPTION) 4—CALL GATE 5—TASK GATE 6—INTERRUPT GATE 7—TRAP GATE
WORDS	(FOR CALL GATE ONLY) NUMBER OF WORDS TO COPY FROM CALLER'S STACK TO CALLED PROCEDURE STACK.
TABLE	0 — USE GDT 1 — USE LDT

Figure 5B. Gate descriptor.

The 16032 contains a number of attractive features. Among them are a 8-byte instruction prefetch queue in the main processor, which helps increase execution speed, and an IEEE-compatible floating-point processor chip called the 16081 Floating Point Unit.



The Professional's Editor for Program Development Word Processing Source Code Translations

Widely acclaimed as an editor, VEDIT has evolved to be much more. Only VEDIT offers the combination of a versatile full screen editor integrated with a powerful command language. For the first time you'll be able to perform complex, yet useful, text manipulations that are virtually impossible with other editors or word processors. Plus, its customizability and hardware support ensure that VEDIT will be perfectly matched to your individual needs and to any microcomputer you are ever likely to own.

With two modes of operation, VEDIT never compromises its speed or ease of use for its power and sophistication. As one reviewer (Bradford Thompson, BYTE) wrote: 'If this review gives you an appetite for simplicity while editing, then VEDIT is well worth considering.' Its command language, based on TECO, is virtually a text oriented programming language, allowing command macros to be created, loaded and saved on disk. Yet its simplicity allows even a novice to perform tasks beyond the capabilities of any word processor.

VEDIT cuts programming time in half - with multiple file handling, macro capability and special features for Pascal, PL/1, 'C', Cobol, Assembler and other languages. And it can help with source code translations (example ZILOG to/from INTEL translator macros are included). A complete line of translators will be available by the year's end.

Word processing is a snap with word wrap, paragraph and print functions. Command macros free you from tedious search/replace operations. Hundreds of search/replace on dozens of files can be performed by VEDIT without waiting or intervening.

VEDIT easily configures to your favorite keyboard layout. Use any function or cursor keys you wish. It optimally supports nearly every 8080, Z80 and 8086 computer.

Go ahead and expect a lot from VEDIT. Its performance and our support will satisfy your most exacting needs.

To order, please specify your 8080, Z80 or 8086 microcomputer, operating system and disk format.

COMPARE VEDIT'S FEATURES

- True Full Screen Editing
- Horizontal scrolling
- Edit files one disk in length
- Automatic Disk Buffering
- Compact (only 16K) and Fast
- Display of line and column #
- Set/Goto text markers
- 'Undo' key to restore line
- Automatic Indent/Undent
- Adjustable Tab positions
- Repeat function key
- Text Move and Copy
- 10 Scratchpad Buffers
- Load/Save buffers on disk
- Powerful command macros
- Directory display
- Edit additional (small) files simultaneously
- Insert another disk file
- Unlimited file handling
- Recovery from 'Full Disk'
- Change disks while editing
- Word wrap, format paragraph
- Simple Printing
- 150 page indexed manual
- Startup command file
- Menu driven installation
- Program CRT function keys
- Support newest CRT terminals
- Support smart CRT functions
- Flexible Memory Mapped support
- Customizable keyboard layout

IBM PC, Displaywriter - Zenith Z100 and Z89 - NEC APC Rainbow and VT180 - Televideo 802
TRS-80 I, II and 16 - Xerox 820 - Apple II Softcard - SuperBrain - NorthStar
MP/M - CP/M-86 - MP/M-86 - Concurrent CP/M-86 - Cromix - Turbo DOS - MSDOS - PC DOS



VEDIT - Disk and Manual
8080, Z80 or IBM PC..... \$150
CP/M-86® or MSDOS®..... \$195
Manual only..... \$18

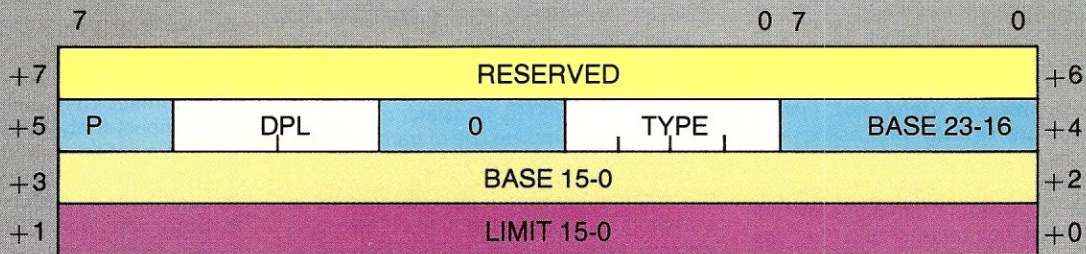
CP/M® and MP/M® are registered trademarks of Digital Research Inc. Apple II is a registered trademark of Apple Computer Inc. MS-DOS and Softcard are trademarks of Microsoft. TRS-80 is a trademark of Tandy Corporation. IBM is a trademark of International Business Machines.

CompuView
PRODUCTS, INC.

1955 Pauline Blvd, Suite 200 Ann Arbor, Michigan 48103 (313)996-1299
CIRCLE 35 ON READER SERVICE CARD

Intel 80286 Segment Descriptors

System Segment Descriptors:



Bit	Name	Function (0)	Function (1)
7	PRESENT	CONTENTS NOT VALID	CONTENTS VALID
6-5	DPL	SEE PRIVILEGE CONTROL	DESCRIPTION
4	—	MUST BE 0	—
3-4	TYPE	SEE BELOW	—

Type	Description
0	RESERVED
1	AVAILABLE TASK STATE SEGMENT
2	LOCAL DESCRIPTOR TABLE (LDT) DESCRIPTION
3	BUSY TASK STATE SEGMENT
4-7	SEE GATE DESCRIPTOR DEFINITION
8-15	RESERVED

Figure 5C. System segment descriptor.

ies would be a good example of modules that could be used by a number of applications running at the same time in a multitasking environment. The MOD register allows these programs to share the same subroutine module without having it as part of each program that requires it. Instead, each program references the module through the MOD register with special access instructions. This reduces program loading and memory requirements since common modules are shared and only loaded once.

Unfortunately, there was a little skimping on the silicon because the MOD register is only 16 bits wide, which means that the module table *must* reside in the first 64K of memory. Although this is a restriction it is not too limiting, since only references to the modules are stored within this space, not the modules themselves. The module table is shown in Figure 12, along with the interrupt vector table and the memory mapping implementation.

The 16082 MMD (Figure 11) is a very interesting piece of hardware. It provides each process with a large linear

address space like that of the Motorola 68000, but it uses memory-resident tables which, like those of the Intel 80286, are automatically referenced and updated by the MMU. This combination leads to a very elegant solution to the problem of handling a large virtual address space, while still allowing a large number of processes to run in a multitasking environment such as a typical multiuser system.

The 16082 MMU takes each address from the 16032 and converts it to a physical address using an internal, associative, address translation cache. It is page oriented, with 512 bytes per page. This allows the nine least significant address bits to be used without any sort of translation. The translation cache contains 32 entries. The operation of the cache is fairly simple and is totally transparent to the program and CPU, unless an error occurs. This will be discussed later.

Logical addresses are presented to the 16082 MMU, which generates a physical memory address. This is done

The 16082 MMD provides a very elegant solution to the problem of handling large vertical address space.

Move up to Microsystems

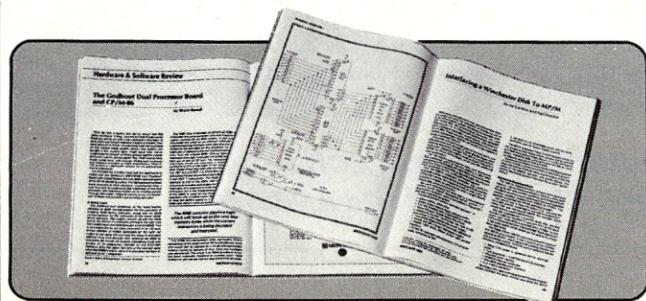
THE JOURNAL FOR SOPHISTICATED
MICROCOMPUTER USERS.

Microsystems is not, in any sense, for beginners. Unlike "personal computer" magazines, *Microsystems* is written *exclusively* for expert users and designers in the software and support hardware field.

If you need a reliable, high-level, up-to-date journal devoted to CP/M®, MP/M®, MS-DOS™, UNIX®, XENIX™, OASIS and other operating systems, then *Microsystems* is for you. We feature tutorials on the modification and special use of systems, offer short-cut routines, show you debugging procedures, techniques for interfacing, and much more. Our one purpose is to keep the advanced microcomputer professional at the leading edge of DOS development and use.

In a few recent issues of *Microsystems* you would have seen:

- Reviews of four C compilers: BDS C, Small C, tiny c TWO™ and Whitesmiths C.
- A programming style comparison: Digital Research PL/I-80™ vs. Microsoft BASIC.
- Twenty-seven 16-Bit DOS compared.
- Virtual segment procedures under UCSD Pascal.
- An in-depth look at MP/M-80 II™.
- A simple 6-byte hexadecimal ASCII conversion routine.
- Using CP/M's undocumented "Autoload" feature.
- An explanation of double density disk controllers.



- A comparison of five popular S-100 disk controller cards.
- OS-1—a UNIX-like DOS with a CP/M adapter.

Every issue of *Microsystems* keeps you at the forefront of the industry in customizing software and adapting hardware to meet new requirements and standards. You'll also find industry news, book and new product reviews, plus our regular *Software Directory* listing newly available programs.

To get the high-level systems information you want, join the club of serious microcomputer professionals who subscribe to *Microsystems*. Use the coupon below to order, and save up to 31%!

PROFESSIONALS PLEASE NOTE:

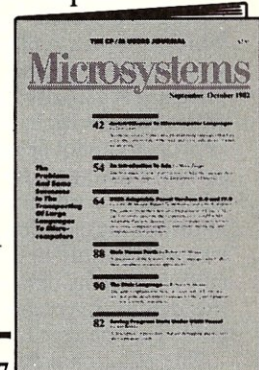
Your subscription to *Microsystems* may be tax deductible. Check with your accountant.

Trademarks:

XENIX: Microsoft; tiny c TWO: tiny c assoc.;
PL/I-80, MS-DOS, MP/M-80 II: Digital Research.

Registered Trademarks:

CP/M, MP/M: Digital Research; UNIX: Bell Laboratories.



Microsystems CN 1987
Morristown, New Jersey 07960

YES, enter my subscription to *Microsystems* for:

- ☐ 12 issues at \$21.97—I save 19%.
- ☐ 24 issues at \$40.97—I save 24%.
- ☐ 36 issues at \$55.97—I save 31%.

Savings based on full 12-issue subscription price of \$26.97 4D297

Mr.
Ms.

(please print full name)

Company

Address

City

State

Zip

CHECK ONE: ☐ Payment enclosed. ☐ Bill me later.

Offer valid in U.S. and possessions only. Please allow 30 to 60 days for delivery of first issue. Satisfaction guaranteed or a prompt refund for unmailed issues.

NEW SUBSCRIBERS ONLY

by taking the two indices in the logical address and comparing them with the contents of the address translation cache. The Page Frame Number (PFN) from the matching cache entry is used in the physical memory address. If no matching entry is found, then the Least Recently Used (LRU) entry is discarded and the PFN for the new address is found by indexing the two Index Page Tables. Accessing the tables, updating the cache, and generating the physical address are done automatically by the MMU.

Parity and nonresident memory page errors are serviced by the supervisor process, which uses a different set of index page tables. The 16032 keeps track of the user/supervisor state and gives this information to the 16082 MMU, which has two Page Table Base registers (PTB0 and PTB1)—one for each state. The 16082 MMU also has a number of other registers, as shown in Figure 12.

These include the page table base registers, the status and error registers, and a number of special registers added just for program debugging. The latter can be extremely useful when building a system and even for debugging application programs. The main difference between the conventional debugging techniques on other systems and the 16032 is that the 16082 MMU keeps track of breakpoint locations and program statistics, whereas conventional debuggers normally replace the code being traced with a special debugging instruction.

In the conventional case, the breakpoint is found by executing the special instruction that calls the debugger, which can then replace the original instruction. There are three disadvantages to this approach. The first is that the program is actually changed when debugging, which may affect its operation. The second disadvantage is that this approach cannot be used to debug ROM-based software or software that may use ROM-based modules. The third disadvantage is more subtle. The 16032 is designed for a multitasking environment; debugging programs in this environment could be a problem if a program using a shared module is being debugged, because setting a breakpoint in this module may cause a trap to occur in a program that is not being debugged.

The additional debugging registers in the 16082 MMU solve these problems by supporting the debugging process without the need for program modification. The breakpoint registers can be set to the address that is to be traced. An interrupt will occur whenever this location is used in the appropriate manner. These breakpoint registers are actually more powerful than the conventional debugging sequence mentioned above because the MMU can trace program execution or variables. A number of other extremely useful options associated with these breakpoint registers make the MMU more powerful than most of the commercially available logic analyzers. The only part that detracts from this debugging feature is that the loading operation is not automatic like the normal virtual memory address translation.

Although the task switch process for the 16032 is not as automatic as in the Intel 80286, it is much better than in the Motorola 68000. This, combined with a powerful instruction set and large address space, make the National

Intel 80286 Segment Descriptors

PHYSICAL MEMORY	
TASK LDT SELECTOR	42
DS SELECTOR	40
SS SELECTOR	38
CS SELECTOR	36
ES SELECTOR	34
DI	32
SI	30
BP	28
SP	26
BX	24
DX	22
CX	20
AX	18
FLAG WORD	16
IP (ENTRY POINT)	14
SS FOR CPL2	12
SP	10
SS FOR CPL1	8
SP	6
SS FOR CPL0	4
SP	2
BACK LINK SELECTOR TO TSS	0

Figure 5D. System segment layout.

Virtual memory and floating-point support will lead to sophisticated systems that are small and inexpensive.

Introducing the powerful, multi-processing HORIZON[®] 8/16 from North Star.

The turbo-charged system with outstanding performance.

The new North Star HORIZON 8/16 microcomputer can handle up to eight individual users, supporting both 8-bit and 16-bit applications simultaneously.

Its advanced, multi-processor architecture makes this powerful performance possible. Unlike other multi-user systems, the HORIZON 8/16 doesn't load up its users on a single processor; instead, it provides a dedicated processor for each individual user—at a cost no greater than that of conventional multi-user systems.

The result? No degradation in processing performance, even when there are eight users on the system.

And North Star's industry standard S-100 bus gives you the flexibility to choose your options and tailor the system to meet your specific requirements.

What's more, the new North Star TurboDOS[®] is many times faster than standard, multi-user operating systems—and is compatible with CP/M-80,[®] CP/M-86[®] and MP/M.[™]

As for reliability, over 30,000 first generation HORIZONS are still in use. And each of these can be easily upgraded to the new 8/16 architecture.

The HORIZON 8/16 outperforms everything in its class. Costs no more. And is the only multi-user micro designed to

meet your needs for today, and tomorrow—simply by plugging in the options you select.

You can discover North Star's HORIZON 8/16 at more than 1,000 computer stores and system houses nationwide. Call 800-722-STAR for the location nearest you. Or write North Star Computers, Inc., 14440 Catalina Street, San Leandro, CA 94577.



NorthStar[™]
Simply powerful solutions.



FLEXI-BUNDLE[™]

Now, select up to \$2,000 worth of free software of **your choice**, when you buy a North Star computer. See your dealer for details.

TurboDOS is a registered trademark of Software 2000, Inc. CP/M-80, CP/M-86, MP/M and CP/M are either trademarks or registered trademarks of Digital Research Inc.
Systems serviced nationwide by M/A/I/Sorbus Service Division.

CIRCLE 11 ON READER SERVICE CARD

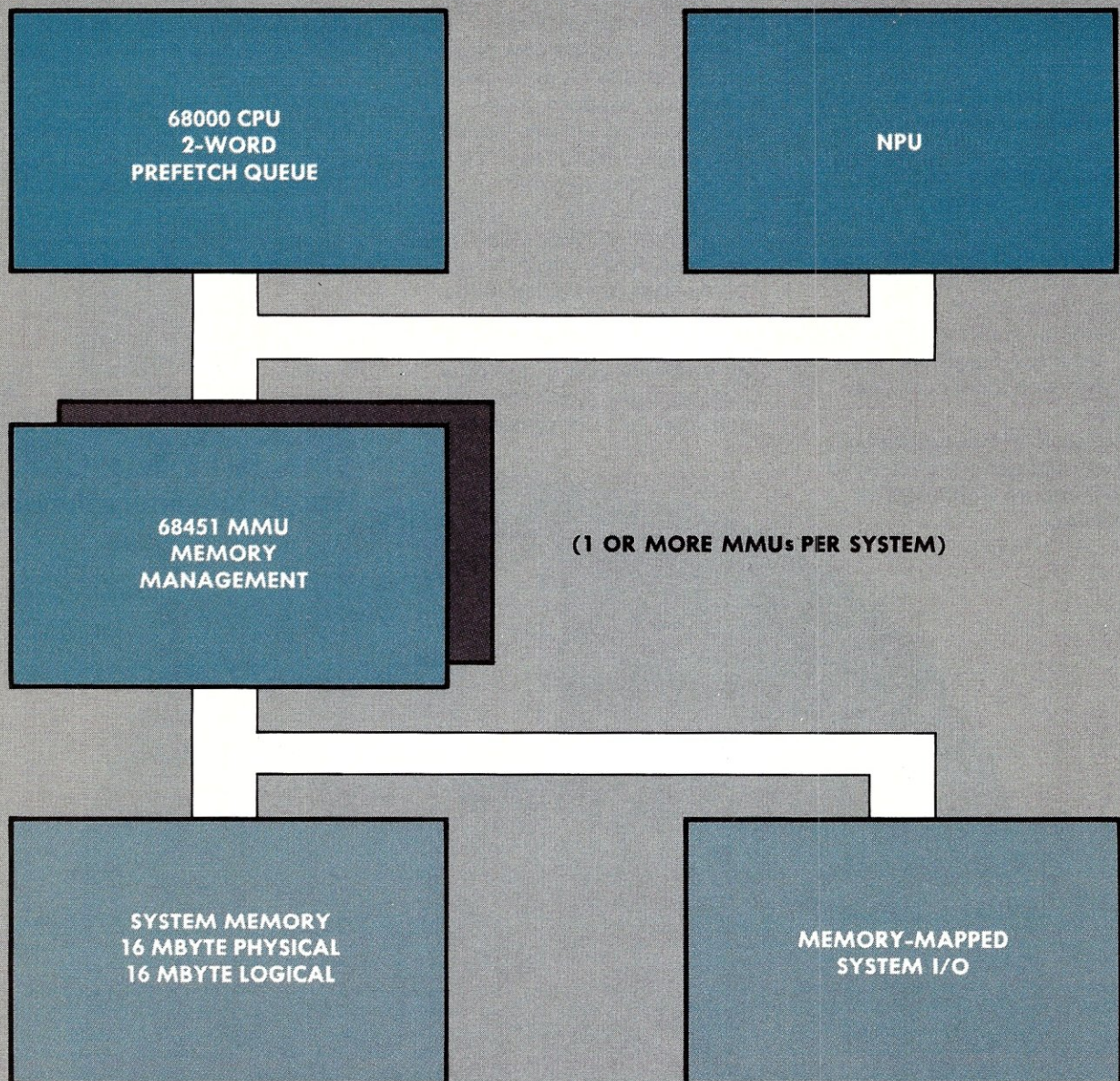
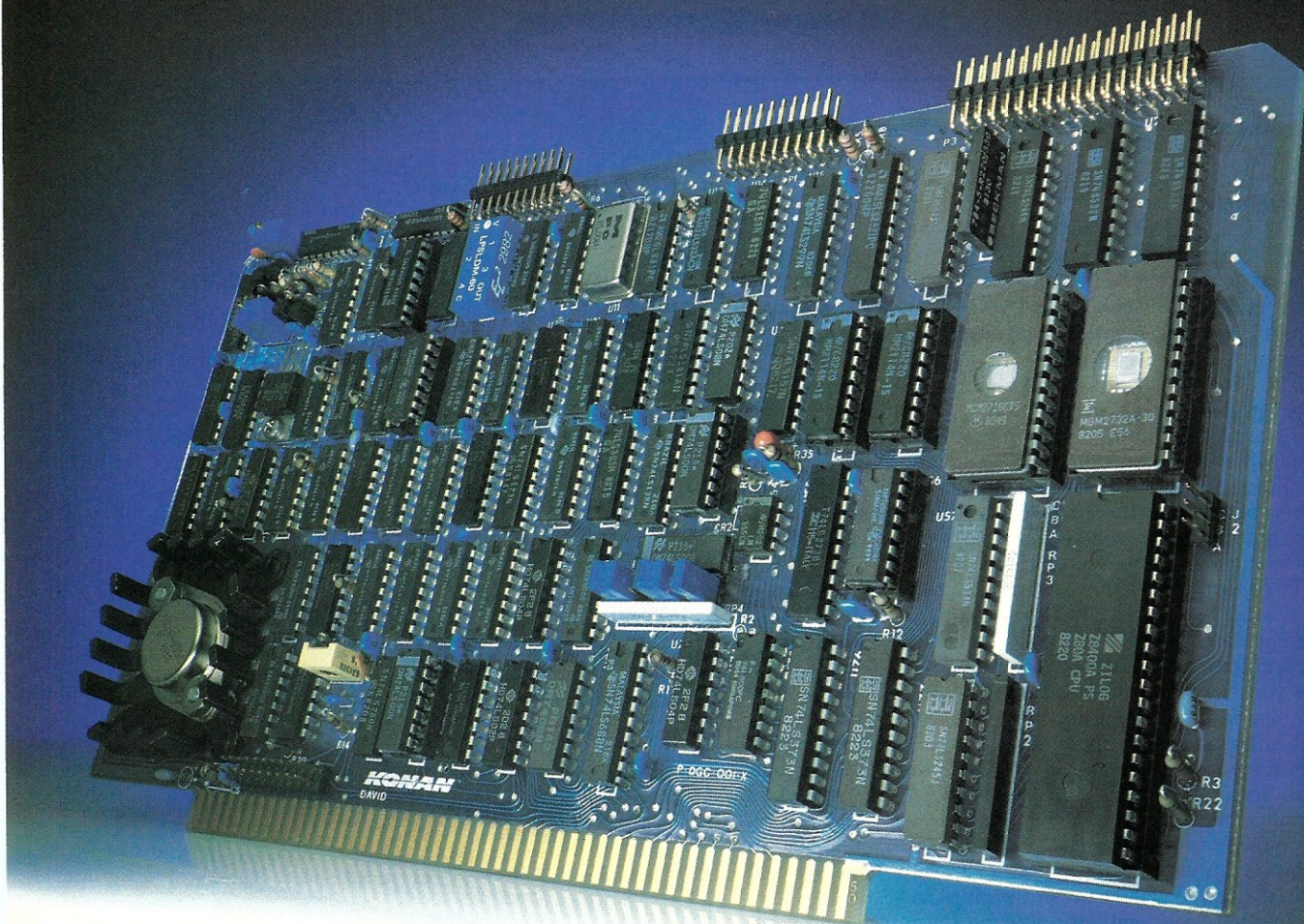


Figure 6. Motorola 68000 system diagram.



ANOTHER S-100 HARD DISK SOLUTION THAT PUTS YOU IN CONTROL.

5 $\frac{1}{4}$ " Winchester control at a price that can't be beat!

\$259 large OEM quantities

From the spectrum of Konan S-100 solutions comes the DGC-100. Offering full sector buffering, error correction, automatic flaw mapping...all standard. The DGC-100 supports the known spectrum of ST-506 compatible drives. And features

what is possibly the best data clock separator on the market today.

Konan's DGC-100. Reliability. High performance. On-time deliveries. And...a low, low price.

For more information or to place an order, write or call:

KONAN^{T.M.}
in control

1448 North 27th Avenue, Phoenix, Arizona 85009
(602) 257-1355, TWX/TELEX 9109511552

CIRCLE 242 ON READER SERVICE CARD

Semiconductor 16032 a very formidable processing system.

Summary

The 80286, the 68000, and the 16032 are all quite sophisticated in design and operation. They provide support for a new range of applications that could not be done using existing microprocessors. Virtual memory and floating-point support will lead to functionally large, sophisticated systems that are physically small and inexpensive.

The Intel 80286's unique design provides a number of new features that make it an interesting candidate for software implementation. The compatibility with the Intel 8086 will add to its popularity. The 80286 has only a 16-bit architecture; however, it provides the largest virtual address space of the three microprocessors discussed. I am sure that the 80286 will become one of the top contenders in the super microcomputer arena.

The Motorola 68000 was the first of the three to arrive on the market; hence, it has an advantage in terms of existing implementations. Although it is the least radical of the three chips covered here, it remains a textbook example of the von Neumann architecture. The 68000 is extremely popular for implementing the UNIX operating system. The interesting thing about the various implementations is that the corresponding MMU is not always used, so that most implementations are incompatible with regard to memory management. In fact, many systems did not require memory management hardware at all, choosing instead to run without the virtual memory support. In any case, the 68000 will be one of the chips to keep an eye on.

National Semiconductor got into the super microcomputer race a bit late with the 16032. They are hoping that is clean design and sophisticated architecture will make it number one in this contest. Inclusion of a single sophisticated MMU within the architecture should lead to common-system architectures in the commercial world, which will benefit application development and ultimately the users, who are really the most important part of the system.

Each super microcomputer examined has its own unique features that make it suitable for particular applications. No one processor appears to be the best in all cases. There are only the first in a line of new super microcomputers, and future versions should prove to be even more interesting.

References

Grappel, Robert D., "Design powerful systems with the newest 16-bit Microprocessor", *EDN*, Sept. 1982.

Intel iAPX 286 User's Manual, Intel Corporation, Santa Clara, CA, 1981.

Intel iAPX 86,88 User's Manual, Intel Corporation, Santa Clara, CA, 1981.

MC68000 16-Bit Microprocessor User's Manual, 3rd ed., Prentice-Hall, Englewood Cliffs, NJ, 1982.

NS16000 Programmer's Reference Manual, National Semiconductor Corp., Santa Clara, CA 1983.

NSC16032S-6,-4 High Performance Microprocessor Data Sheet, National Semiconductor Corp., Santa Clara, CA, 1982

Motorola 68000 CPU Block Diagram

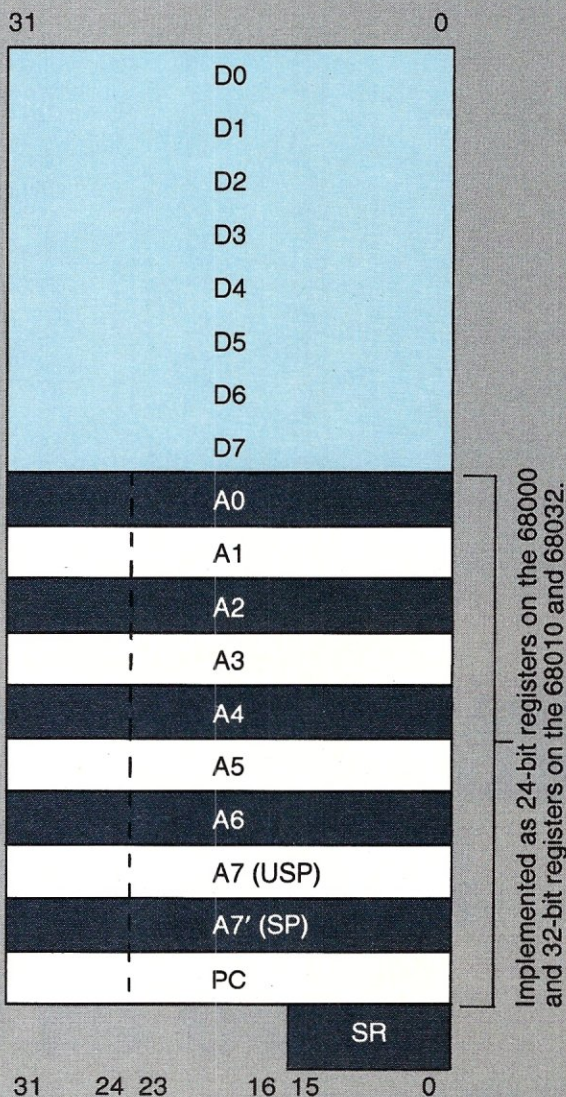


Figure 7. Programmer's model of 68000.

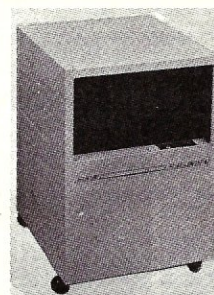
Each super microcomputer reviewed has unique features that make it suitable for particular applications.

TURN-KEY, TURBO-DOS BUSINESS SYSTEM

This system is tailored to the needs of the individual customer and as such provides that touch of freedom desired by the business system buyer. **SYSTEM-1** is truly "TURN-KEY", just unpack the equipment, connect the cables, turn it on, and you are up and running. There are numerous **SYSTEM-1**'s meeting the requirements of the small to moderate size business currently in today's market.

SYSTEM-1 can support up to fifteen users, a batch processor, and up to eight printers. Other options, such as "**SEMIDISK**", are available to the user when the need arises. The attractive all metal enclosure will complement any office decor, as will the **ADM-11** consoles, and the **MPI 150G PRINTMATE** printers.

- 5 USERS
- 2 PRINTERS
- 5 CONSOLES
- 1 Z80A CPU
- 6 Z80B CPU'S
- 2 8" DRIVES
- 15 MEGABYTE HARD DISK
- 832k BYTES OF MEMORY
- ATTRACTIVE ENCLOSURE
- TURBO-DOS 1.22
- TURBO-PLUS 1.03



- CCD CONFIG 1.02
- ALL CABLES
- MANUALS
- PREPAID SHIPPING

SAVE OVER \$3000.00

The system software is "**TURBO-PLUS**", an extended version of "**TURBO-DOS**". This package is compatible with "**CP/M**", and "**MP/M**", providing the user with a wealth of commercial software. **TURBO-PLUS** provides the user with several major advantages over other "**CP/M**" compatible systems, such as a **TWX** command for interconsole messages, a **MAIL** command to leave a message, special "**LOGON**" and "**LOGOFF**" commands for proper access and daily **BULLETINS**. If desired, the system will also maintain daily log entries including system access notations.

Users can be assigned their own work areas, thus one user can not affect another. All user printing is "**SPOOLED**" and will not tie up the users console. In addition, time consuming printing and other processes may be "**QUEUED**" or "**BATCHED**" to be run later.

Included is a free membership to "**TUG**" (Turbo Users Group) which provides a forum for **TURBO-DOS** users.

The complete **SYSTEM-1** will be shipped prepaid to your location ready to operate, with the exception of your application software.

ORDER #CCD-09001-00.....\$15,499.95

STD HEIGHT 5.25" FLOPPY DISK DRIVES

CCD08207-02 MPI B51 40 trk, 1 side	\$199.95
CCD08201-02 MPI B52 40 trk, 2 side	\$264.95
CCD08206-02 MPI B91 80 trk, 1 side	\$269.95
CCD08202-02 MPI B92 80 trk, 2 side	\$369.95

HALF HEIGHT 5.25" FLOPPY DISK DRIVES

CCD08204-05 SA-465, 80 trk, 2 side	\$379.95
CCD08203-02 MPI 902, 80 trk, 2 side	\$369.95

STD HEIGHT 8" FLOPPY DISK DRIVES

CCD08205-02 Gume 842, 77 trk, 2 side	\$579.95
--	----------

HARD DISK DRIVES, 5.25"

CCD08501-02 ST-419, 19 meg	\$999.95
----------------------------------	----------

HARD DISK SUBSYSTEMS, 5.25"

CCD09201-08 11 Megabyte, CP/M	\$1699.95
CCD09202-08 22 Megabyte, CP/M	\$2199.95
CCD09203-08 44 Megabyte, CP/M	\$3099.95

PRINTERS, RS-232 SERIAL

CCD08701-02 MPI Printmate 150G w/softkey, & 4k buffer	\$1199.95
CCD08703-04 Prowriter 2, 1550	\$ 739.95
CCD08705-04 Prowriter 8510	\$ 569.95



CCD08204-05 SA-465



HARD DISK SUBSYSTEMS



CCD08601-02 LSI, ADM-11

CRT TERMINALS, RS-232

CCD08601-02 LSI, ADM-11	\$559.95
CCD08602-09 GUME, QVT 102	\$559.95

TELETEK IEEE-696 S-100 CARDS

CCD-08101-01 Systemmaster CPU	\$589.95
CCD-08102-01 SBC-1 4mhz, 64k, Slave	\$579.95
CCD-08103-01 RAM-64k, Expand to 256k	\$359.95
CCD-08104-01 RAM-256k	\$659.95
CCD-08105-01 PSIO, Quad RD232	\$219.95
CCD-08106-01 HDTC, Disk/Tape Control	\$524.95

NOVATION MODEMS

CCD-08801-06 Novation 212 auto cat	\$589.95
CCD-08802-06 Novation D-cat modem	\$164.95
CCD-08803-06 Novation J-cat modem	\$119.95

8" CP/M SOFTWARE

CCD-07001-01 CP/M 2.2, Teletex	\$150.00
CCD-07002-06 M.S. BASCOM-80	\$249.95
CCD-07003-06 M.S. Cobol-80	\$469.95
CCD-07004-06 M.S. Fortran-80	\$314.95
CCD-07005-06 M.S. MBASIC-80	\$219.95
CCD-07006-06 M.S. Multiplan	\$179.95
CCD-07007-06 Perfect Calc/Filer	\$299.95
CCD-07008-06 Perfect Writer/Speller	\$274.95
CCD-07009-06 Supercalc	\$124.95
CCD-07010-06 Supercalc II	\$195.95

(713) 488-9754

Circle reader Service number 90 for more information

COMPUTER COMPONENT DISTRIBUTION

2600 Skywalker, #2101
Houston, Texas 77058

VISA & M.C. welcome, Sorry No C.O.D.
Checks take 4 weeks.
Prices subject to change.
ADD 5% shipping, plus 4% tax (Texas).

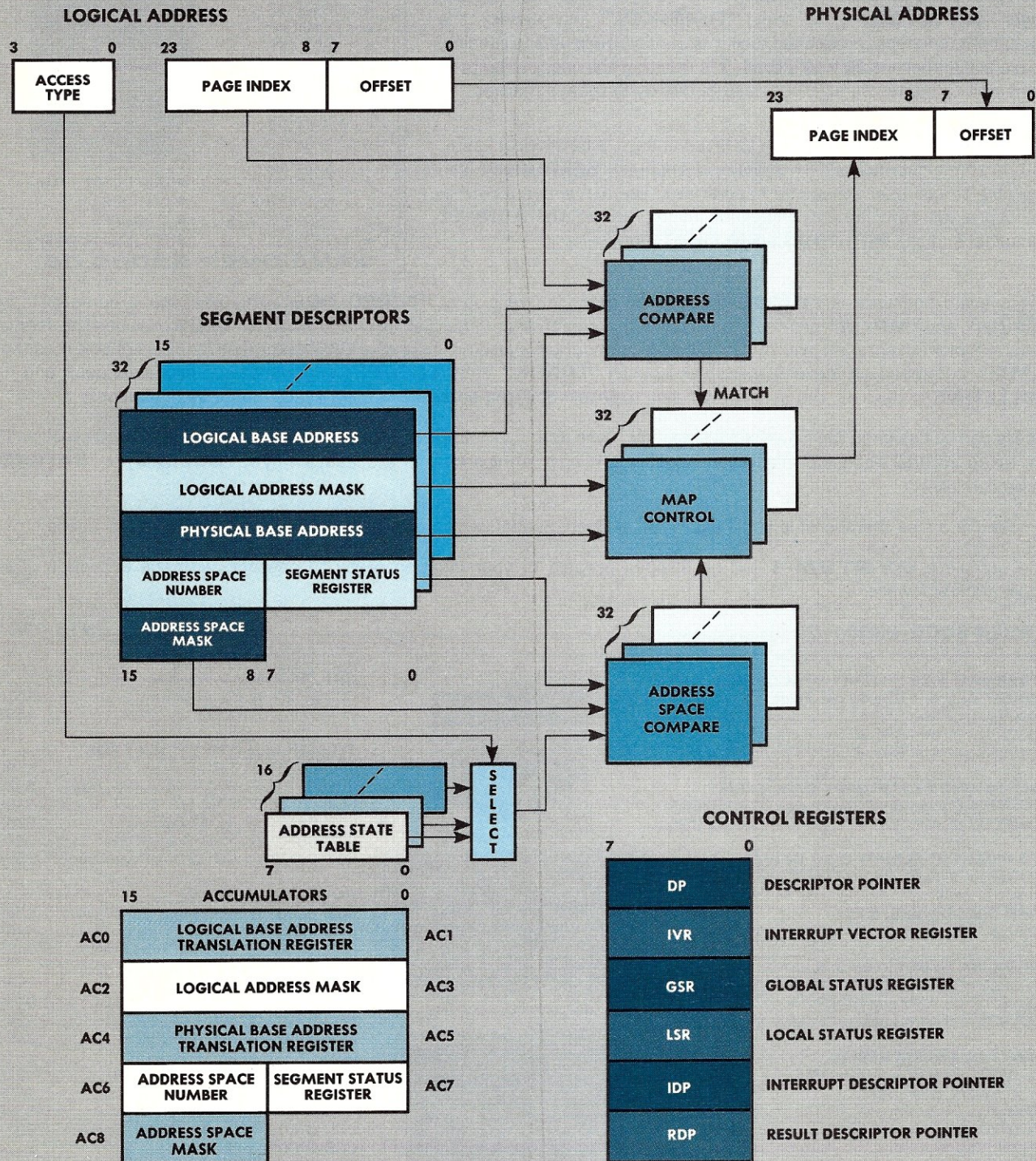


Figure 8. Motorola 68451 MMU block diagram.

ERG/68000

MINI-SYSTEMS

- ☐ Full IEEE 696/S100 compatibility

HARDWARE OPTIONS

- ☐ 8MHz, 10MHz or 12MHz 68000 CPU
- ☐ Memory Management
- ☐ Multiple Port Intelligent I/O
- ☐ 64K or 128K STATIC RAM (70 nsec)
- ☐ 256K/512K or 1MB Dynamic RAM, with full parity (150 nsec)
- ☐ 5¼"-8" DID, D/S floppy disk drives
- ☐ 474MB hard disk drives
- ☐ Full DMA Disk Interface
- ☐ SMD Interface
- ☐ ¼" tape streamer
- ☐ 10 to 20 slot backplane
- ☐ 20 or 30A amp power supply
- ☐ Desk top or Rack mount cabinets

SOFTWARE OPTIONS

- ☐ 68KFORTH¹ systems language with MACRO assembler and META compiler, Multi-user, Multi-Tasking
- ☐ Fast Floating Point package
- ☐ Motorola's MACSBUG
- ☐ Unix²Type Operating System with C, PASCAL, FORTRAN 77, 68K-BASIC¹, CIS COBOL⁴, RDBMS
- ☐ CP/M-68K³ O/S with C, Assembler, 68K-BASIC¹, 68KFORTH¹, Z80 EMULATOR¹, FORTRAN 77
- ☐ Unix² System III with C, etc.
- ☐ VED68K¹ Screen Editor

Trademark ¹ERG, Inc.

²BELL LABS

³Digital Research

⁴Micro Focus

30 day delivery

with valid Purchase Order

OEM prices available

For CPU, Integrated Card Sets
or Systems.



Empirical Research Group, Inc.

P.O. Box 1176

Milton, WA 98354

206-631-4855

ERG SOFTWARE AVAILABLE FOR:

CP/M-68K³ O/S: 68K FORTH¹, 68K-BASIC¹
VED68K¹ Screen Editor,
Z80 Emulator¹, FORTRAN 77

Motorola KDM Board: 68KFORTH¹

Motorola MVME 110: 68KFORTH¹

NEW PRODUCTS IN DEVELOPMENT 68000/16032 Processors

For The
VME Bus

10MHz ERG/VME 16032

/w 16082 MMU \$1995

/w 16081 FPU \$2495

12 MHz ERG/VME 68000

/w 68451 MMU \$2495

/w 16081 FPU \$2695

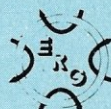
ERGFORTH¹ (68KFORTH¹) Kernal and Compiler in resident ROM. Complete ERGFORTH¹ Systems Language available for both processors. Call for additional software availability.

AVAILABLE: 68000 — Now

16032 — 1st qtr. 1984

Trademark ¹ERG, Inc.

³Digital Research



Empirical Research Group, Inc.

P.O. Box 1176

Milton, WA 98354

206-631-4855

16-Bit Super Micros continued . . .

Additional information may be obtained from:

Intel

3065 Bowers Avenue
Santa Clara, CA 95051
(408) 987-8080

CIRCLE 346 ON READER SERVICE CARD

Motorola Semiconductor Products, Inc.

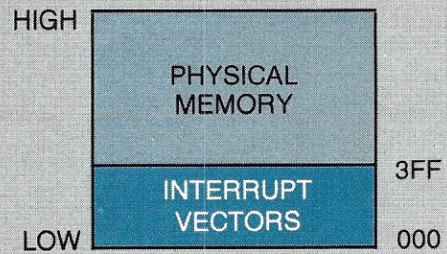
P.O. Box 2593
Phoenix, AZ 85062
(602) 244-6900

CIRCLE 347 ON READER SERVICE CARD

National Semiconductor Corp.

2900 Semiconductor Drive
Santa Clara, CA 95051
(408) 721-5000

CIRCLE 348 ON READER SERVICE CARD



HIGH-ORDER BYTE OF A WORD IS STORED FIRST

Figure 9. Motorola 68000 memory map.

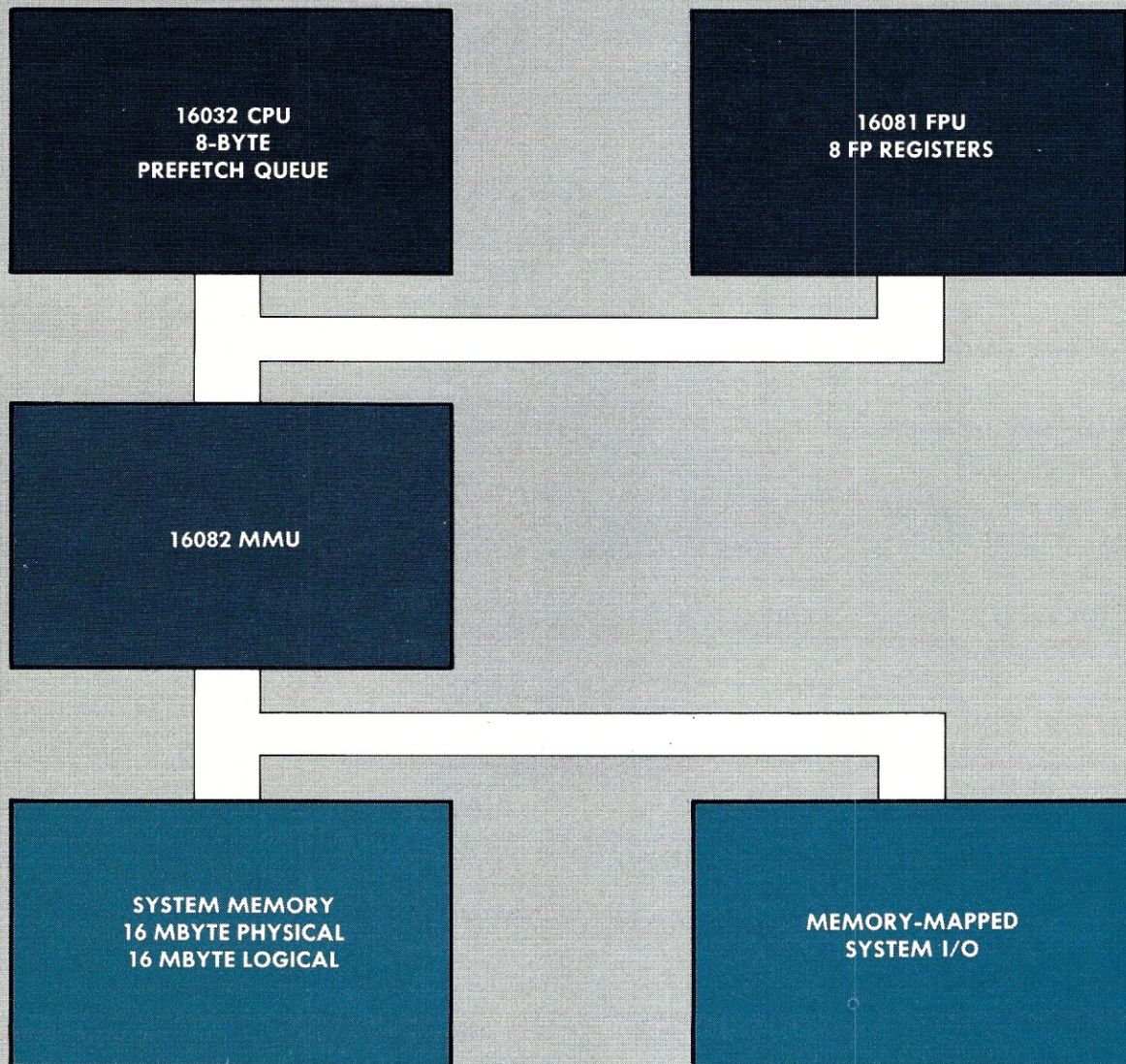


Figure 10. National Semiconductor 16032 system diagram.

USE MAGIC/L™ TO WRITE JUST ONE PROGRAM



Bet you can't stop with one.

For just \$295 MAGIC/L™ is yours. And suddenly you find you've bought more than a language. MAGIC/L is an entire interactive environment; an assembler, a compiler, an editor, an I/O package, and a system call facility are all wrapped up and delivered. And now MAGIC/L is available for CP/M-based computers.

MAGIC/L is easy to learn. It has syntax similar to C and Pascal, and because it's extensible as well as interactive, it dramatically increases productivity.

Program development features include a built-in text editor, command line recall, CCP, STAT, and PIP command emulation, and the ability to store keyboard dialog on disks.

Key language features include: CHAR, INTEGER, LONG, REAL, and String data types; record structures similar to the STRUCT facility in C; and a complete I/O package that can provide random access, variable length I/O to any CP/M file.

And MAGIC/L offers great portability. Source code which runs on CP/M can be compiled unmodified and run on any other processor.

Typical applications include hardware interfacing, process control, games creation, interactive graphics and image processing. MAGIC/L has made programming easier for DEC, 68000, and Data General users. Now it's working for CP/M users too.

MAGIC/L provides everything you need to write a complete program. But the only way to be convinced is to try it yourself. Send us your \$295 check or money order—we also accept MasterCard and VISA—we'll send MAGIC/L for CP/M to you at once. A full money back guarantee is part of the package. Once you've sampled that first program, you'll have to try another . . . and another . . . and another. MAGIC/L . . . it's more than a language.

MAGIC/L . . . It's more than a language



LOKI ENGINEERING, INC.

55 Wheeler St., Cambridge, MA 02138 (617) 576-0666

CIRCLE 61 ON READER SERVICE CARD

MAGIC/L is a trademark of Loki Engineering, Inc.
DEC is a trademark of Digital Equipment Corporation.
CP/M is a trademark of Digital Research, Inc.

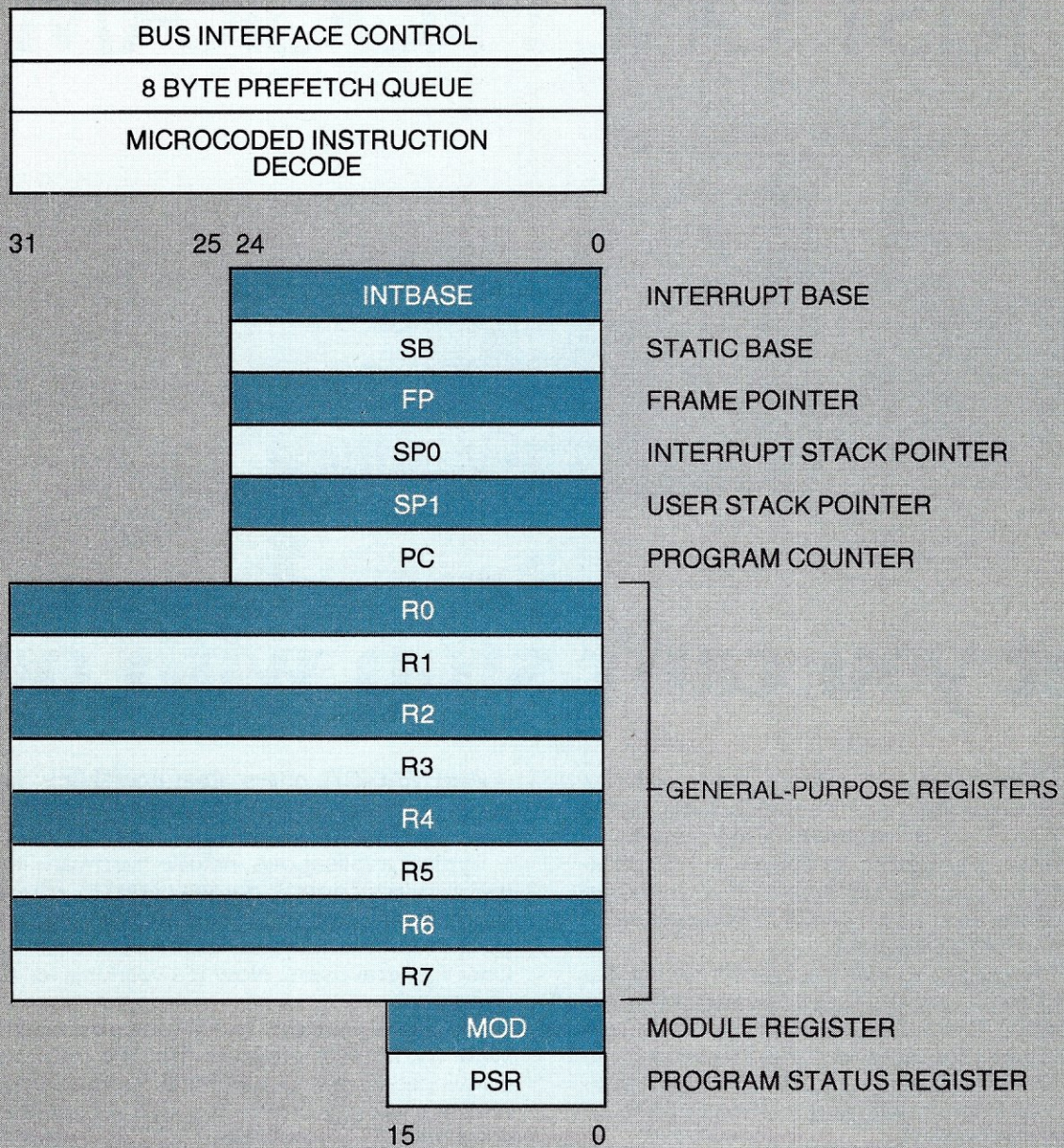


Figure 11. NS 16032 CPU block diagram.

16-Bit Super Micros continued . . .

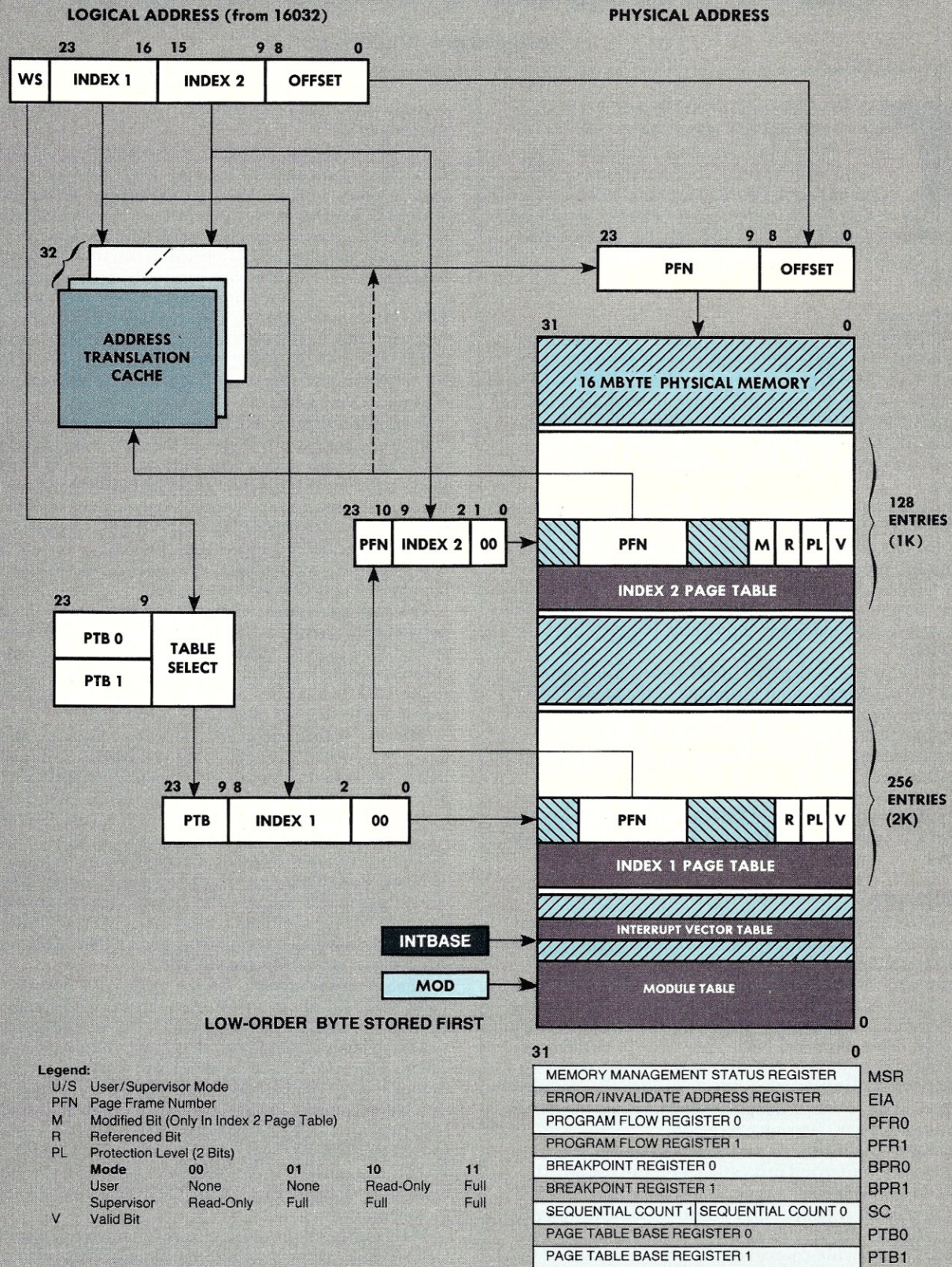


Figure 12. NS16082 MMU block diagram.

The CompuPro CPU-68K

by Dave Hardy and Ken Jackson

The CPU-68K 16-bit 68000-based CPU board is one of CompuPro's latest entries into the 16-bit S-100 market. The board is offered ready-to-run with various configurations of other CompuPro boards, and is available with either the CP/M 68K or Forth operating systems. For those who prefer their own O/S, the CPU-68K also has provisions for up to 16K (8K words) of on-board 2716, 2732, or 2764 EPROM.

Features

The CPU-68K is available either A&T (assembled and tested) with an 8 MHz clock and a one-year limited warranty, or in a 10 MHz version under the CompuPro CSC (Certified System Component) program with a two-year warranty. The 8 MHz version costs \$695, and the 10 MHz version sells for \$850. Both boards also have the ability to run at half-speed (4 MHz or 5 MHz) by just flipping a switch.

Provision has been made on the board for an optional 68451 MMU (Memory Management Unit), although it was not yet available when we tested the CPU-68K. CompuPro recommends that the board be returned to the factory for installation of the MMU so that it can be completely tested before use. At the time of this writing, the 68451 was not able to operate properly at speeds in excess of 4 MHz.

Also included in the CPU-68K board are a unique jump-on-reset feature (that is, unique to the 68000 CPU), vectored interrupt ability, 24-bit addressing, full IEEE-696 compatibility when run at or below 6 MHz, and programmable wait states (which comes in handy with older, slower memory boards).

The quality of the CPU-68K board itself is, like all other CompuPro boards, excellent. It is obvious that CompuPro makes a conscious and effective effort toward quality control.

Hardware

The CPU-68K is literally packed full of features that merit description. Following are brief descriptions of some of the more interesting ones:

Interrupts. Probably the most interesting of the CPU-68K's features is its built-in interrupt system. CompuPro has chosen to use the 68000's built-in prioritized interrupt ability to drive the S-100 NMI* line and six of the seven vectored interrupt lines, VI0 through VI5. A jumper option is also available to allow the CPU-68K to use the S-100 INT* line to signal temporary bus masters to release the bus for master interrupt processing.

The CPU-68K is able to use its own internal ("auto vector") mode for interrupt processing, or it can use an external interrupt controller (CompuPro recommends the System Support I). A jumper is provided to allow the user to select whether a byte-wide or a word-wide response is expected. This is an unexpected but very useful feature of the CPU-68K board that makes it a great deal easier to use in

existing systems and, potentially, a lot more versatile in future systems.

Power-on-Jump. Another interesting feature of the CPU-68K is its Power-On-Jump (POJ) ability. This is done in a way similar to the one used in many S-100 boards with POJ features. At system reset, an on-board EPROM is enabled to provide an initial jump address. However, after a reset, the 68000 CPU reads the two double words (8 bytes) starting at address zero and loads them into its stack pointer and program counter, respectively. The on-board EPROM is disabled by any memory write. CompuPro recommends that the first instruction executed after a reset be a JSR (that's a CALL instruction to us Z80 folk) to force the 68000 to push the return address onto the stack and thus disable the EPROM.

I/O. Although the 68000 uses memory-mapped I/O, CompuPro has cleverly designed the CPU-69K to perform S-100 I/O cycles to conform with the IEEE-696 requirements. This means that the system I/O devices will appear to the programmer as memory addresses (from 0FF0000H to 0FFFFFFH), but to the S-100 bus as I/O devices! This method allows the CPU-68K to have IEEE-696 16-bit I/O addressing ability, but still allows older 8-bit addressing I/O devices to be used.

Programmable array logic. In order to cram all these goodies onto a single S-100 board, CompuPro used several special ROM chips, called PALs, to perform many of the complicated logic functions required, such as the interface to the S-100 control bus, and the state machine used to decide if one or two bus operations are needed.

Memory management unit. Dynamic memory allocation is provided by the optional 68451 MMU IC. If this option is not installed, the address bus of the 68000 directly drives the address bus drivers. If the 68451 MMU is installed, then it adds the ability to map a virtual address from the 68000 to a physical address that is sent out to the S-100 bus. Using the 68451, it is possible to "re-map" S-100 extended address memory to appear in almost any extended page. Just to make life easy for the programmer, when the MMU is initially reset, it starts up in a "transparent" mode in which no remapping occurs. The MMU itself is located in extended page OFEH.

Miscellaneous signals. Unlike some CPU boards, the CPU-68K will allow an external device to generate the MWRT (Memory WRiTe) signal. This feature allows a system to have a front panel, since most front panels must generate the MWRT signal in order to work properly. Although it is not required by the IEEE-696 standard, provision has been made in the CPU-68K to allow it to tristate (and thus turn OFF) its own master system clock signal Φ (pin 24 on the S-100 bus). Using pin 21 as PHI-DSB*, and NDEF line in the current IEEE-696 standard, slave processors can actually turn off the CPU-68K's clock and insert their own.

Wait states. Wait-state circuitry is provided on the CPU-68K to allow virtually any type of slow device to work properly. From one to five wait states may be independently selected for I/O cycles, ROM cycles, M1 cycles, and/or all cycles.

Dave Hardy, 736 Notre Dame, Grosse Pointe, MI 48230

Software. Software provided with the CPU-68K comes in two basic flavors, mapFORTH and CP/M-68K, both available from CompuPro.

- mapFORTH is a stand-alone operating system with several basic utilities, such as a screen-oriented line editor, a full 68000 assembler, a debugger and miscellaneous utilities.

- CP/M-68K is, of course, Digital Research's 68000 version of the popular CP/M operating system, which is so remarkably like regular old CP/M that it needs no additional explanation, except that it also comes with a C compiler.

Because neither of us speaks fluent FORTH, all of our evaluations were made while running under CP/M-68K. We were provided with several different implementations of CP/M-68K while we were evaluating the CPU-68K, each one less buggy than its predecessor. The final implementation that we received (late in August '83) had no major bugs. Source code for the CompuPro BIOS is included, so we could have easily changed the BIOS to do whatever we wanted.

Two different versions of CP/M-68K are provided on two separate disks. The first disk contains a CP/M system that uses a System Support 1 for the console, requires 256K of RAM, and expects that its floppy drives can step at 3 ms. The second disk contains a system that expects to see an Interfacer 3 (user 7) or an Interfacer 1 addressed at port 10H, and requires only 128K of RAM and floppies with an 8 ms step rate.

The only real problem we had with the software was the relative lack of canned software for CP/M-68K. No doubt, this problem will eventually disappear, as it did for the 8086/8088, when CP/M-68K becomes more widely used. Many of the benchmark tests that we usually perform on a new board couldn't be performed because we didn't have the proper applications software. In our sorting tests, runtime measurements were about the same for the CPU-68K as they were for the IBM-PC. Unfortunately, they can't be considered valid because the 68000 code was generated by translating the programs from 8086 code. Our suspicions are that the 68000 is a great deal better at sorting when its programs are optimized for the 68000.

Documentation

Documentation provided for the CPU-68K is a single concise manual of about 20 pages. It includes a technical overview, a theory of operation, a jumper and switch set-up summary, schematic diagrams, and a board layout drawing. Although brief, the manual provides all of the information necessary to understand the operation of the CPU-68K board, except for the 68000 IC itself. All of the jumper and switch settings are explained in the text, although a knowledge of reading schematic diagrams is necessary to really understand what some of the jumpers do.

Similar manuals are provided for the mapFORTH and CP/M-68K operating systems. These manuals, however, give exact descriptions of exactly what to do to set up a system to run their operating system. Instructions are given for setting up most of the CompuPro I/O boards to work with the particular operating system, right down to the exact switch and jumper settings on each board.

System start-up and use

In any case, no matter which operating system you choose,

you'll need to have the following to bring up the CPU-68K:

- An S-100 frame
- A CPU-68K board
- A CompuPro System Support 1 or Interfacer 3 or 4 board
- A CompuPro DISK 1 floppy disk controller
- At least 128K of RAM
- At least one 8" floppy drive, with cable and power supply
- A serial terminal and cable set up for 9600 baud, 8 bits, no parity, and 1 stop bit.

To start up the system, you'll have to set up each board according to the instructions given in the manual for the operating system that you've chosen. There are *many* jumpers to be set, so this will take a while. Fortunately, the operating system manuals tell you how to set up *all* of the boards, so you don't have to waste a lot of time paging through each of the technical manuals trying to figure out which jumper goes where.


Although the systems are provided on single-sided disks, double-sided floppy drives will also work, and double-sided disks can be read and written once the system is booted up.

Likes/dislikes

We were impressed with the quality and reliability of the hardware provided for our tests. Once the system was running, we really had no problems at all. Our biggest complaint was that if the system didn't start up, we wouldn't know where to start looking. An EPROM monitor or at least some built-in diagnostics would come in very handy for troubleshooting in the event of system trouble. To a certain extent, we could tell if the problem was in the floppy controller or CPU board, but if there had been an I/O problem, we would have been in deep trouble to diagnose it from the system's reactions. This is a problem in any turn-key type of system.

Our only other complaint was that the operating systems provided each required at least 128K of RAM. This isn't really a terrible problem, considering the fact that this is such a high-powered system, but it would be nice to be able to start up with just a single 64K RAM board, even if just for test purposes.

Conclusion

The 68K is truly a generation ahead of most of the 8-bit machines commonly associated with the S-100 bus. Its powerful instruction set and high speed make it a versatile machine easily capable of multiuser, multitasking applications far in advance of those available in the 8-bit world. The CompuPro CPU-68K gives the advantages of the 68000 CPU to the S-100 bus without adding any limitations. It is particularly suited to interrupt-driven multiprocessor applications, and can perform these within the IEEE-696 specifications, which is no small design achievement. The CompuPro people really did their homework on the design of this board. 

For more information, contact:

CompuPro
3506 Breakwater Court
Hayward, CA 94545
(415) 786-0909

CIRCLE 320 ON READER SERVICE CARD

The CompuPro CPU-68K gives the advantages of the 68000 CPU to the S-100 bus without adding any limitations.

The CompuPro System 8/16 Model 86/87 Computer

by Andrew L. Bender

Bill Godbout has built a solid reputation among the S-100 user community. This reputation has been earned by hard work and a dogged adherence to the IEEE-696 standard. Especially considering the contributions to the IEEE-696 standard made by Mark Garetz of the CompuPro staff, the entire product line is an advertisement for excellence in electronics. I was invited recently to use the CompuPro System 8/16 Model 86/87 as my development system; this report resulted from my experiences with the 8086 computer board, the 128K RAM-21, and a DISK-1 controller board. I also got a 3" stack of manuals, two 8" floppy disks containing CP/M-86, some headaches, and a peek at what level of system performance will result from the use of this board set. The Intel Corporation engineered and produced the 8086 microprocessor as one member of a 16-bit microprocessor series known as the iAPX-86/88 series.

Let me say at the outset that my review was impartial. Godbout had no idea that I would be receiving this board set, what I would use it for, and how or in what configuration I would put it together. I have no connection with Godbout Electronics, and I have had no communication with them during the time that I prepared this report. I did speak to Intel Corporation to get some information on the line of coprocessors for the iAPX-86 family, which I incorporated into this report. In order to get the information I did identify myself as a writer of "a feature article on the 8086."

The 8086 processor board

The 8086/87 board is marketed as the "CPU 86/87" in two grades. The normal grade board is assembled and tested and has a one-year warranty. A faster board with direct replacement service and a two-year warranty is available at a slightly higher cost under the CompuPro CSC (Certified System Component) program. If you know little about computers and don't want to be bothered with looking for someone to fix them, I would recommend purchase of CSC boards.

Both boards contain the 8086 processor, a socket for the 8087 math coprocessor, the 80130 "silicon operating system" support chip and the "glue" chips that make it work in the IEEE-696 environment. If you buy the board with the 8087 math coprocessor, the 8087 socket will, of course, contain this chip. I didn't have an 8087 chip on my board. Godbout states that although the board is field-upgradable to contain the 8087 chip, they very strongly recommend that you return it to them to have this chip installed. Because of the arbitration of signals between the 8086 and 8087, you cannot just plug in the 8087—some changes need to be made to the foil lands on the board to accommo-

date this additional processor. When you add the 8087, the 8086 cannot be operated at its full-rated speed of 8 MHz (10 MHz for CSC boards) because the fastest 8087 in current production runs at 5 MHz. This causes the overall performance of the board on non-8087 tasks to be degraded. If you do a lot of software development work such as text editing, compiling, and assembling, you are probably better off not dragging around the extra burden of a chip you won't often use.

The 8087 is a fantastic partner in cases where the 8086/87 would be employed as a digital filter, in complex signal processing, and in image processing or similar applications with a large computational overhead. This board, together with accurate analog-to-digital and digital-to-analog converters, has many applications in neurophysiological signal processing, and I was tempted to take my computer to the office to hook up to my electrooculography equipment.

The 80130 chip, as marketed by Intel, usually contains a ROM with operating system firmware—normally the nucleus routines for Intel's proprietary operating system iRMX-86. In addition to the ROM, the 80130 also contains an interrupt controller similar in many respects to the 8259A and a set of interval timers similar to the 8253/54. Godbout supplies the 80130 chip, without the ROM, on his CPU 86/87 board so that all you get is the interrupt controller and the interval timers. The CPU 86/87 board is arranged so that if you want to use the 80130 chip *with* the iRMX-86 firmware or the 80150 chip *with* the CP/M operating system and BIOS I/O drivers in ROM, you can set the starting address of the firmware in a DIPswitch on the board. While some data on the 80130 was given in the manual, the assumption is that you will know all about this relatively new chip. It would have been better to reprint the technical data on the chip and include it in the manual.

The remaining chips on the board serve to interface the board with the S-100 bus. I used revision B of this board in my tests. Documentation was terse but complete. The usual section for "I can't wait to get it into my mainframe and running" freaks occupied the first page of the manual.

8086 architecture

The 8086, unlike its 8-bit counterpart, the 8088, fetches 8 or 16 bits per fetch from the data bus. There is a 6-byte instruction queue, rather than the 4-byte queue of the 8088. Like the 8088, instructions may be from one to four bytes in length. Unless a jump instruction occurs, the 8086 fully overlaps instruction fetch with instruction execution. These differences result in higher internal speeds for the 8086 and result in higher throughput. The instruction queue also lessens the demands on the memory bus. The 8- or 16-bit data bus fetch requires that the system contain word-wide memory. The 8088 always fetches 8 bits at a time from the data bus, so there is no problem in using your old memory boards. Enter the new CompuPro RAM-21 board. This board uses a programmed logic ar-

Andrew L. Bender, M.D., Neurological Services, Inc., 336 Center Avenue, Westwood, NJ 07675

ray to control all of the fetches possible, since it looks like two 64K static boards to an 8-bit system but a single word-wide 64K static board to a 16-bit system.

The 8086 interfaces with the outside world by means of address lines, data lines, and control signals. Intel Corporation has invested a considerable amount of effort in developing a complete line of coprocessors that complement the iAPX-86 line of microcomputers. The 8087 is the best known of these coprocessor chips, but there are I/O processors, text processors, graphics display processors, even local area network processors—which all work with the iAPX-86 chip set. For the hardware hacker it should be possible to put one of these coprocessors on a little carrier board and plug it right into the 8087 socket.

The RAM-21 memory board

The board runs without wait status at 8 MHz. I didn't test it in a faster environment. The "B" version of the board that was supplied did not have any stated operating speed. Note that the board can be addressed only on a 128K boundary. It cannot be used in an 8-bit 808X system where MP/M II or CP/M-80 Plus is used, because there is no provision for the global memory needed in a banked system. There are no board options; a DIPswitch provides the start address for the memory board. The board is neatly laid out and constructed, with four regulator chips at the top of the board where the heat will go up and out of the enclosure instead of across all of those heat-sensitive chips. Since this board is not the focus of this review, I will not discuss it further.

The Disk-1 controller card

This disk controller card features a full 24-bit DMA transfer. Since there is no commercially available LSI DMA controller chip supporting 24-bit transfers, these are done with "glue." Lots of chips provide fully arbitrated, 24-bit DMA transfers from a floppy disk to the IEEE-696/S-100 bus. In addition to the floppy disk I/O functions, a serial I/O port is included on the Disk-1 card. This port, called the "bitbanger," is intended to be used only to "bring up a system," not as a standard serial I/O channel. The data are sent to the port by serializing them in software and then presenting them, one bit at a time, at a programmed speed so that the software takes the place of a hardware baud rate generator and UART. This technique, it might be remarked, was the way of doing serial I/O in the days when UARTs were expensive. The idea is that you can get the system up with the bit banger port on the Disk-1 card; you can then program the other hardware in your system to really get running. There is a major catch. The bit banger doesn't work with CP/M-86. You need a serial I/O port that is either on a CompuPro Serial I/O card or on the System Support Card.

The actual disk interface is through an Intel 8272 floppy disk controller chip. This chip allows a variety of sectoring choices and is an example of the latest in LSI circuitry. A reprint of Intel's 8272 chip data is presented in the Disk-1 manual.

The Disk-1 card requires that the system memory be phantomized out during booting. A 2716 EPROM on the Disk-1 board contains eight boot routines to be used with

different hardware and software configurations. There is provision for adding wait states to the EPROM boot routines and to the DMA transfers by means of a DIP-switch and a jumper plug. Each of the boot routines is switch selectable by the user, but the EPROM is divided in two sections. One section is for the 8-bit processors such as the Z80, 8080, and 8085. The other section is for 16-bit processors such as the 8088 or 8086. One half of the eight-position DIPswitch selects the appropriate boot programs for a given processor, and a jumper plug sets the appropriate processor. The other half of the DIPswitch sets the priority of the Disk-1 board as a temporary bus master. Since the EPROM can be changed, you are not bound to the hardware routines in the boot EPROM.

The Disk-1 board layout is dense and neat; locations are clearly identified with silk-screen legends. The board is solder-masked on both sides and appears to have been wave soldered. Because of the density of the components on the board, some jumper plugs are hard to remove and insert, and a surgical "mosquito" clamp is a definite aid to changing these plugs. I used board revision "F" in these tests.

The controller can be used with 5 $\frac{1}{4}$ " or 8" floppies. When minifloppies are used, it is necessary to make some minor alterations to the PC board. Computer House, 501 "B" Street, San Rafael CA, 94901 offers a version of MS-DOS on 8" disk for the Disk-1 controller board and the 8086/87 CPU card. I did not have the opportunity to try this system.

Getting it all together

I brought my system up under CP/M-80, then switched it to CP/M-86 after a lot of problems of varying magnitudes. Headaches, which began with the statement that the bit banger port couldn't be used with a 8086/87 system, turned into real pain when I tried to configure my disks to use the Disk-1 card.

Though it would have been easy to plug in my CompuPro disk system and give a glowing report, it would not have been fair to a reader trying to decide whether it was worth going out, spending a fairly substantial sum, and configuring an 8086/87 system. I had two old Memorex 550 drives which are single-sided old beasts that have coexisted with my Micromation Doubler System. That system, second-hand when I bought it, has worked flawlessly for four years. The Memorex drives were not double sided, but since the preconfigured CompuPro CP/M-86 system only uses one side, it could be booted from them without being modified.

The memory-mapped Micromation controller card would not run with the high-speed 8086/87. It contains an EPROM with 8080 instructions that are executed by the CPU in order to perform memory-mapped disk transfers, and it was not designed to run at any speed above 4 MHz.

I had to modify the Memorex drives to allow the stepper motors to be energized forever, and jumpered and unjumpered some options that were not used on the Micromation system. A statement in the Disk-1 manual stuck in my mind "... they (the stepper motors) will get warm." Warm was a typical computerese understatement. They were damn near hot enough to fry an egg on! Yes, my drive box was well ventilated! Memorex does not recom-

What to run it in? You don't own an old shoebox? How about an old IMSAI? Well, unplug the front panel, plug in a terminator card, and it does run. But without the terminator, forget it! Too much noise and crosstalk.

mend keeping the stepper motors of the 550 floppy drive energized, but the 8272 disk controller scans the connected drives, requiring the stepper motors to be energized at all times. Finally I did get the thing to work, but only after a lot of tinkering with the software, and I admit that I got the system up with CP/M-80 2.2 running first. It was a big task to get CP/M-86 up after that, but not impossible—I mean, I did know that the Disk-1 board and drives were working properly when I saw the system boot CP/M-80.

Now, ready to try anything, I tried to get my ancient Altair/Pertec FD-400 drives up with the Disk-1 card. No luck. The Intel 8272 chip really needs the drives to look like Shugart floppies. The Altair drives have a Step In line and a Step Out line instead of a Step and Direction line. Having visions of adding little circuits to provide these functions to the Altair Buffer Boards in these drives, I quit this project.

The mainframe

What to run it in? You don't own an old shoebox? How about an old IMSAI? Well, unplug the front panel, plug in a terminator card, and it does run. Without the terminator? Forget it! Too much noise and crosstalk. It does run very well in the CompuPro Enclosure. It will run in an Altair 8800b without a front panel. Just leave the motherboard and power supply and add a terminator card. While writing this report, a power dip occurred. Both the IMSAI and CompuPro systems were powered up. The IMSAI crashed, but the CompuPro kept going. I guess that the constant-voltage transformer really does work.

Serial I/O

Now for the easy part: communications. You really need a device that will run at the speed of 8086/87 CPU. An old IMSAI 2S10/2 card won't work. Even correcting the board—so that it takes its address from the low-order eight address lines and its clock signal from the CLOCK, line 49, instead of $\Phi 2$, line 24—won't help. It's just too slow. The Altair 2S10/2 was just as bad. It didn't work either. I tried the CPU 86/87 board with my PMMI modem card, and it did work. The CompuPro serial I/O boards, at least the Interfacer-1, work with it.

Summarizing the experience: For a novice it will be frustrating or impossible to get this three-board set working with older S-100 hardware. For an experienced hacker, it will not be a simple task but it can be done. I advise the use of a Godbout Interfacer-1 or System Support Card and a double-sided, double-density disk system to get the system up and running.

The stepper motors *will* burn out in any drives without proper cooling. The disk drive power supply must be adequate to handle the burden of those steppers being turned on at all times. The poorly designed disk power supply, whose +24 volt supply is marginal and designed with the idea that the steppers won't be used continuously, will not run reliably with the Disk-1 board, and that is a fact proven by trying several cheap disk cabinets and drives.

With respect to the software, I advise that if you are bringing up a non-CompuPro system, bring up CP/M-80 *first*. If you have little experience with bringing up CP/M,

then just don't bother. Get someone to do it for you or buy the recommended hardware. If you are going to bring up CP/M-80, you will need the voluminous listings in the Disk-1 manual. You will be spending about 80 to 100 hours to get things working perfectly, including getting CP/M-86 up after CP/M-80. You will need a copy of Sorcim's ACT assembler and a good text editor. You will also need a lot of patience and the dogged determination of a real CP/M hacker who could bring up CP/M with GETSYS and PUTSYS. Don't work when tired. Good luck. The experience is worth it, but it can be frustrating.

Documentation

CompuPro manuals are OK but not great. The fact that the information is there is not a consolation. It is sometimes buried, hard to find, or discernable only by rereading material several times. I find myself becoming irritable and annoyed when the material is more disorganized than I remembered it to have been from my last reading. The manual is easy to read, but there isn't much text when you consider that there are the necessary software listings, circuit diagrams, and reprints of chip manufacturer's data sheets. The manuals need to be brought up to the quality of the electronics.

The Digital Research CP/M-86 manuals are as bad as the CP/M-80 manuals. They are just prettier. What can anyone say? It is all there—but try to find it. The same errors in the CP/M-80 manuals have found their way into the CP/M-86 manuals. The manuals, are, however, similarly disorganized, so that if you remember where the information was in the CP/M-80 manual set, you probably won't be disappointed with the CP/M-86 set. Thank God that all of the information (and I especially hope the jumbled presentation) is proprietary to Digital Research, including the errors—certainly no one else would lay claim to these manuals, perhaps the epitome of poor writing. On the other hand, the Concurrent CP/M-86 manual for the IBM PC is well written, and its slick presentation makes you wish that DR had done the same for CP/M-86. While on that subject, I don't know who wrote the End User License Agreement; perhaps he or she could get a job in the technical writing department. The agreement is clearer than the manuals!

Getting it up and running

Not a task for the neophyte if you are using a mixture of CompuPro and non-CompuPro hardware. I suggest you buy your system from an authorized CompuPro dealer who can configure the system for you if you have little or no experience in this area.

I recommend the CompuPro hardware for several reasons: First, it is designed into the software. This is not a trick to make you buy the hardware. You can configure it yourself. It is rock-solid stuff with a very good warranty. Second, it is all *strictly* IEEE-696/S-100 hardware. There are no catch phrases, such as "complies with IEEE-696 . . ." or "compatible with S-100 systems." Third, Godbout stands behind his line. He has been in business for some time and has earned respect for his work.

Decide what you are going to use this hardware for. If it

The CompuPro hardware is rock-solid stuff with a very good warranty, and it is designed into the software.

☐ APPLE ☐ EAGLE ☐ IBM, PC ☐ NORTHSTAR ☐ TRS-80 II 8" ☐ OSBORNE ☐ FRANKLIN ☐ STANDARD CP/M 8" ☐

RENT SOFTWARE BEFORE YOU BUY!

from our SOFTWARE RENTAL LIBRARY

You can now RENT the most popular software available for just
20-25%* of Manufacturers' Retail Price

- Eliminate the risk—rent first!
- 100% of rental fee applies toward purchase
- All purchases are 20% Off of Manufacturer's Suggested List
- Rentals are for 7-days (plus 3 days grace for return shipping)

SPECIAL INTRODUCTORY OFFER

There are now 2 different plans to choose from:

Join the **Game Group**, \$25.00 per year and rent as many games as you like for only 20-25% of Mfrs. Sugg. Retail Price.*

Minimum order, 3 game rentals

Join the **Business Group**, \$50.00 per year and rent as many business application programs as you like for only 20-25% of Mfrs. Sugg. Retail Price.*

REMEMBER, THESE ARE NOT DEMOS, BUT ORIGINAL UNRESTRICTED SOFTWARE PROGRAMS

(complete with manuals in original manufacturers' packages)

To Immediately Order, or for more information:

UNITED COMPUTER CORP.
Software Rental Library
Culver City, California

Canadian Orders Welcome

Toll Free CALL 1-800 992-7777

In California CALL 1-800 992-8888

In L.A. County CALL 1-213 823-4400



*Plus postage and handling.

☐ EDUCATIONAL ☐ ACCOUNTS RECEIVABLE ☐ WORD PROCESSORS ☐ DATA BASES ☐ LANGUAGES ☐ GRAPHICS

CIRCLE 4 ON READER SERVICE CARD

ACCOUNTS PAYABLE ☐ MAILING ☐ SPELLING ☐ COMMUNICATIONS ☐ REAL ESTATE ☐ TAXES ☐ STOCK MARKET ☐ INVENTORIES ☐ HEATH/ZENITH 89 8"

XEROX 820 ☐ GAMES ☐ COMPILERS ☐ UTILITIES ☐ BUSINESS ☐ ACCOUNTING ☐ SPREAD SHEETS ☐ MEDICAL ☐ DENTAL ☐ PAYROLL ☐ GENERAL LEDGER

64K S100 STATIC RAM

\$199⁰⁰
KIT

NEW!

LOW POWER!
RAM OR EPROM!

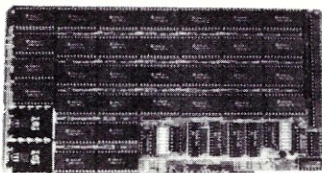
BLANK PC BOARD
WITH DOCUMENTATION
\$55

SUPPORT ICs + CAPS
\$17.50

FULL SOCKET SET
\$14.50

FULLY SUPPORTS THE
NEW IEEE 696 S100
STANDARD
(AS PROPOSED)
FOR 56K KIT \$185

ASSEMBLED AND
TESTED ADD \$50



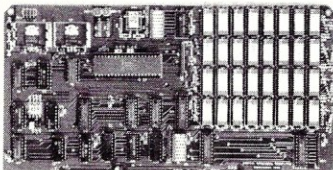
FEATURES:

- * Uses new 2K x 8 (TMM 2016 or HM 6116) RAMs.
- * Fully supports IEEE 696 24 BIT Extended Addressing.
- * 64K draws only approximately 500 MA.
- * 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- * SUPPORTS PHANTOM (BOTH LOWER 32K AND ENTIRE BOARD).
- * 2716 EPROMs may be installed in any of top 48K.
- * Any of the top 8K (E000 H AND ABOVE) may be disabled to provide windows to eliminate any possible conflicts with your system monitor, disk controller, etc.
- * Perfect for small systems since BOTH RAM and EPROM may co-exist on the same board.
- * BOARD may be partially populated as 56K.

256K S-100 SOLID STATE DISK SIMULATOR!
WE CALL THIS BOARD THE "LIGHT-SPEED-100" BECAUSE IT OFFERS AN ASTOUNDING INCREASE IN YOUR COMPUTER'S PERFORMANCE WHEN COMPARED TO A MECHANICAL FLOPPY DISK DRIVE.

FEATURES:

- * 256K on board, using + 5V 64K DRAMS.
- * Uses new Intel 8203-1 LSI Memory Controller.
- * Requires only 4 Dip Switch Selectable I/O Ports.
- * Runs on 8080 or Z80 S100 machines.
- * Up to 8 LS-100 boards can be run together for 2 Meg. of On Line Solid State Disk Storage.
- * Provisions for Battery back-up.
- * Software to mate the LS-100 to your CP/M* 2.2 DOS is supplied.
- * The LS-100 provides an increase in speed of up to 7 to 10 times on Disk Intensive Software.
- * Compare our price! You could pay up to 3 times as much for similar boards.



BLANK PCB
(WITH CP/M* 2.2
PATCHES ON DISK)
\$69⁹⁵

\$399⁰⁰

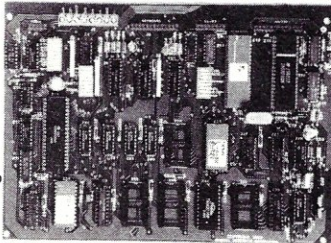
#LS-100 (FULL 256K KIT)

THE NEW ZRT-80 CRT TERMINAL BOARD!

A LOW COST Z-80 BASED SINGLE BOARD THAT ONLY NEEDS AN ASCII KEYBOARD, POWER SUPPLY, AND VIDEO MONITOR TO MAKE A COMPLETE CRT TERMINAL. USE AS A COMPUTER CONSOLE, OR WITH A MODEM FOR USE WITH ANY OF THE PHONE-LINE COMPUTER SERVICES.

FEATURES:

- * Uses a Z80A and 6845 CRT Controller for powerful video capabilities.
- * RS232 at 16 BAUD Rates from 75 to 19,200.
- * 24 x 80 standard format (60 Hz).
- * Optional formats from 24 x 80 (30 Hz) to 64 lines x 96 characters (60 Hz).
- * Higher density formats require up to 3 additional 2K x 8 6116 RAMs.
- * Uses N.S. INS 8250 BAUD Rate Gen. and USART combo IC.
- * 3 Terminal Emulation Modes which are Dip Switch selectable. These include the LSI-ADM3A, the Heath H-19, and the Beehive.
- * Composite or Split Video.
- * Any polarity of deo or sync.
- * Inverse Video Capability.
- * Small Size: 6.5 x 9 inches.



BLANK PCB WITH 2716
CHAR. ROM, 2732 MON. ROM

\$59⁹⁵

SOURCE DISKETTE - ADD \$10
SET OF 2 CRYSTALS - ADD \$7.50

ZRT-80

WITH 8 IN.
SOURCE DISK!

\$129⁹⁵

(COMPLETE KIT,
2K VIDEO RAM)

Digital Research Computers

P. O. BOX 461565 • GARLAND, TEXAS 75046 • (214) 271-3538

TERMS: Add \$3.00 postage. We pay balance. Orders under \$15 add 75¢ handling. No C.O.D. We accept Visa and MasterCard. Texas Res. add 5% Tax. Foreign orders (except Canada) add 20% P & H. Orders over \$50 add 85¢ for insurance.

CIRCLE 63 ON READER SERVICE CARD

Model 86/87 continued . . .

is a serious and important use, then you don't want the stuff breaking down all the time. You will need to pay a bit more for this.

Testing

I used two configurations for testing. The first had an IMSAI mainframe with the original motherboard but the front panel removed. A terminator card was always used. The Disk-1 board drove two Memorex 550 drives reconfigured to match the proper requirements. A 64-Kword RAM-21 board, Interfacer-1, and CPU 86/87 was used. The second used a CompuPro Enclosure-2, CompuPro Disk Subsystem, and the same boards. There was no difference in performance, but the double-sided double-density Qume drives provided better throughput than the single-sided double-density Memorex 550s.

In closing, there is only one problem with 8086/8088 systems, and that is software. Most 8086/8088 software is reheated, warmed over, or mechanically translated 8080/Z80 code. None of this will show the virtue of the 8086 system to an advantage. Until the software base matures, most users will not gain a real advantage from the use of this excellent hardware.

For additional information, contact:

CompuPro
3506 Breakwater Court
Hayward, CA 94545
(415) 786-0909

CIRCLE 345 ON READER SERVICE CARD

"C" PROGRAMMERS

COMPARE and EVALUATE compilers, libraries, editors, operating systems, toolkits, debuggers, emulators... Feedback from commercial product developers, beta test users, compiler writers identified 18 C compilers for the 8086, 9 for CPM. Below are the products that stand out. Ask about other languages.

If we don't stock it, we'll find it - at a discount.

"C" Compilers

For 8086:

C86 by CI - Full "C" for MSDOS/CPM86
Desmet by C Ware
Digital Res. - looks good, work to do
Lattice - strong competitor, MS -REL
Manx - full - good to learn with
MicroSoft - decent, not what you'd think

For 8080 or Z80:

BDS C - with debugger, overlays
EcoSoft C - for Z80, full K&R, tight ASM
Manx - Aztec C - 8080/Z80, full, Link, ASM

For APPLE DOS, Atari, Commodore:

Manx - Aztec C - Full, ASM, Link, Editor
For 6809, RSX, TRS80, crosscompile,?

LIST
PRICE

OUR
PRICE

"C" Books - (as a convenience)

"C Programming Language"

by K&R - Standard reference \$24

"C Programmer's Guide" by

Purdham, QUE - Learn C \$20

Utilities

MicroShell - upgrade CPM 150 125

GRAPHICS: Halo \$139 GSX 60 50

ISAM: PHACT for C 250 225

Cache/Q - Virtual Memory 225 185

Programmer's EDITOR

C Screen Editor - source code NA 60

VEDIT - popular, full 150 119

PMATE - everything, program 225 195

Final Word - Manuals & Editor 300 225

Concurrent OSes

Concurrent CPM - linked 350 265

Concurrent "PCDOS" NA 159

QNX - w/tight C Compiler 650 call

uNETix-w/MSDOS emulator 99 89

Call for answers, the Programmer's Referral List, a catalog, comparisons, literature or prices. Shipping \$2.50 per item.

THE PROGRAMMER'S SHOP™

908-D Providence Hwy., Dedham, MA 02026, 617-897-4750, 800-442-8070

VISA

800-421-8006

MASTER CARD

CIRCLE 72 ON READER SERVICE CARD

Compilers and **C**ross compilers

TELECON'S C COMPILERS OFFER YOU

- FULL C
- UNIX* Ver. 7 COMPATABILITY
- NO ROYALTIES ON GENERATED CODE
- GENERATED CODE IS REENTRANT
- C AND ASSEMBLY SOURCE MAY BE INTERMIXED
- UPGRADES & SUPPORT FOR 1 YEAR

IN THESE CONFIGURATIONS:

HOST	6809 TARGET	PDP-11*/LSI-11* TARGET	8080/(Z80) TARGET	8088/8086 TARGET
FLEX*/UNIFLEX* 6809	\$200.00 WITHOUT FLOAT \$350.00 WITH FLOAT	500.00	500.00	500.00
RT-11*/RSX-11* PDP-11*	500.00	200.00 WITHOUT FLOAT 350.00 WITH FLOAT	500.00	500.00
CP/M* 8080/(Z80)	500.00	500.00	200.00 WITHOUT FLOAT 350.00 WITH FLOAT	500.00
PCDOS*/MSDOS* 8088/8086	500.00	500.00	500.00	200.00 WITHOUT FLOAT 350.00 WITH FLOAT

Others Pending

C SOURCE AVAILABLE FOR \$2,500⁰⁰

SO ... IF YOU'RE READY TO MOVE UP TO C ...

CALL

408-275-1659

TELECON SYSTEMS
1155 Meridian Avenue, Suite 218
San Jose, CA 95125

*PCDOS is a trademark of IBM CORP. MSDOS is a trademark of MICROSOFT. UNIX is a trademark of BELL LABS. RT-11/RSX-11/PDP-11 is a trademark of Digital Equipment Corporation. FLEX/UNIFLEX is a trademark of Technical Systems consultants. CP/M is a trademark of Digital Research.

CIRCLE 269 ON READER SERVICE CARD

An Introduction to Local Area Networks: Part II

by William G. Wong

In Part I of this article (*Microsystems*, October 1983) we examined the generalized model of a computer network provided by the ISO standard. We now consider aspects of implementing the model. This is the final article of a two-part series.

LAN topology, access methods, and protocols

Topology. Local area network topology, access methods, and protocols apply to the Data Link and Physical Layers on the ISO model. The three are related in that certain topologies dictate corresponding access methods and protocols. As mentioned before, the topology of a network may change depending upon the viewpoint. A description of basic network topologies is presented first, and is followed by a general description of the access methods and protocols. These facets will then be combined and described with regard to different viewpoints. The basic topologies are:

1. Bus
2. Fully Interconnected Point-to-Point
3. Irregular Point-to-Point
4. Star
5. Tree
6. Ring
7. Chain
8. Matrix

The Bus topology (Figure 1) is the simplest form. Every node is connected to a common communication link, usually serial in nature. Only one node can send information at one time, and all other nodes can receive the information. A node can check the destination of a particular message and simply ignore the information not destined for that node. The advantages of such a topology are: 1) connection to the bus is usually simple; 2) any node can send information directly to any other node. The disadvantages are: 1) only one node can send information at a time, which makes the bus a potential bottleneck if it has insufficient bandwidth; 2) the bus itself offers a single failure point that could halt the entire system.

The Fully Connected Point-to-Point system (Figure 2) is also a simple configuration. In this case, each node is connected to every other node in the system by a dedicated communications link. The advantage is that the communication between nodes is full duplex; that is, nodes can simultaneously send and receive information. It also offers the best throughput of any design, since there are many communication links within the network. Routing is easy, since information is sent directly to its destination and failure of a single link will not cause the entire network to fail. The disadvantage is that the cost and complexity grow at an amazing rate, making this configuration impractical for systems with more than 20 or so nodes. This is because the

number of communication links per node is directly proportional to the number of nodes; thus the total number of links grows as the *square* of the number of nodes.

The Irregular Point-to-Point topology (Figure 3) is designed to reduce the number of physical connections, compared to that in a Fully Interconnected version, while keeping the reliability of the system high because the failure of a single link does not cause the entire system to fail. The disadvantage is that the routing of information becomes a very complex software problem, since information may have to be sent through other nodes to reach its destination. Going through one or more intermediate nodes increases the time required for a message to reach its destination and requires additional buffer space in each node for message forwarding.

The Star topology (Figure 4) is also simple and very similar to the Bus and Fully Interconnected Point-to-Point topologies. The Central Node can operate in one of two modes. In the first mode, the Central Node is analogous to the Bus in that all information will be sent from one node through the Central Node to the destination node. In the second mode, the nodes communicate only with the Central Node, which supplies services to them. The advantages are that the failure of a communications link will not cause the entire system to fail, and that the number of connections at a node is always one; this makes routing very simple. The disadvantage is that failure of the Central Node halts the entire system.

The Tree topology (Figure 5) is actually a hierarchical form of the Star topology. It has a simple routing scheme and is less vulnerable to failure of a communications link. It does have the disadvantage that messages often must go through intermediate nodes to reach their destination.

The Ring topology (Figure 6) is a simple connection method in which each node is attached to two neighbors. Routing is easy, since a message simply moves around the ring until it reaches its destination. Information is usually sent around the ring in only one direction; but this has the disadvantage that a failure of any node or communications link causes the whole ring to fail.

The Chain topology (Figure 7) is really a Tree topology where each node is restricted to having, at most, two communication links or a broken Ring topology. The advantages and disadvantages are the same as for the Tree topology. The Chain topology is often called the "daisy-chain" topology.

The final topology mentioned here is the Matrix topology (Figure 8). It is really a Regular Point-to-Point topology with the same advantages as the Irregular Point-to-Point topology; in addition, the routing procedure is very simple. The disadvantage is that a message usually goes through more than one node before it reaches its destination. Also, failure of a node or link makes the routing process as complex as for the Irregular Point-to-Point topology.

William Wong, 902 B Merritt Drive, Somerville, NJ 08876

Access methods. The network access methods are part of the low-level physical operation of the network. Some access methods are simple, while others are very complex, with many dependencies. An access method is required when more than one node can request the use of a communications link at one time. There is an obvious need for an access method on a bus topology, but access methods can also apply to other topologies, depending upon their implementation.

The Point-to-Point, Tree, Chain, and Matrix topologies do not require an access method, since the communication links between nodes are dedicated. The Star topology also does not require an access method if the nodes communicate only with the Central Node, and the Ring topology does not need an access method if messages can be passed from one node to another at any time. This leaves the Star topology, where the nodes communicate with each other through the Central Node, some implementations of the Ring topology, and the Bus topology.

The Star is actually a very familiar system which is often supplied by the telephone company. The simplest form of this system is called a Private Branch Exchange (PBX). This is a switching system which allows nodes (telephones in some cases) to be connected together. The access method is the procedure to make or break a connection.

The Bus and Ring topologies are those usually discussed with regard to LANs, and they are also the two which have the largest number of different access methods. It turns out that both can use the same types of access methods. This is because a ring operates essentially like a bus if only one node can send information at a time and data always traverses the entire ring once. The three access methods for these two topologies, illustrated in Figure 9, are:

1. Time division multiplexing
2. Token passing
3. Carrier sensing

Time-division multiplexing operates in a synchronized fashion, where each node is allocated a fixed time slot within a predefined cycle. A node can send a message to another node during its time slot. This method allows for synchronization, total access by any node, and priority messages. It is usually used in GANs, since transmission occurs at a predefined time. The disadvantage is that the bandwidth of a channel may not be fully utilized.

The token-passing access method uses a logical item called a token, which is passed from node to node. The token is usually a short, specially formatted message. The node which has the token can either send a message to another node or send the token to another node. Only the node containing the logical token can send a message.

The token-passing access method can provide priority control by having the token passed to high-priority nodes more often than to low-priority nodes. This method also provides high channel utilization, since token passing requires little overhead and all remaining time can be used to send information. An important advantage in some instances is that the message delay time may vary with system loading, but will usually be less than the upper delay limit. The token-passing method also operates more efficiently if most nodes send large bursts of information at long time intervals.

The disadvantage of the token access method is its complexity. The nodes must be able to distinguish the token from other messages. There must also be a method of generating a new token if the current one disappears. This can happen for a number of reasons, including noise on the communication links. Adding active nodes to the system can also be a problem, since a token is sent only to an active node which is known, and newly activated nodes are ignored.

The carrier sense access methods are also called Carrier Sense, Multiple Access (CSMA) methods. They do away with many characteristics that are disadvantageous for the token-passing access method, but pick up others that are advantageous. The carrier sense access method is very simple. A node wishing to send a message will first listen to the communications link. It will send the message if a message is not currently being sent; otherwise, it will wait until transmission of the other message is complete before sending the message.

Two problems can occur when two nodes wish to send a message at the same time. In the first case, both nodes see an inactive link and immediately start to send their messages. In the second case, they both see the end of a message just sent by a third node and again begin sending simultaneously. In both cases the result is a garbled message. This is called a collision. Notice that a collision will only occur for the two cases mentioned, and not while a message is being sent; so the problem does not occur all the time. The collision problem can be resolved in two ways.

The first is called Carrier Sense, Multiple Access/Collision Avoidance (CSMA/CA). This method simply tries to make the time that a collision can occur as small as possible, has an easy and reliable way to detect garbled messages, and requires that messages be acknowledged by the destination. The first two items can be done in hardware and the latter in either hardware or software. A message is retransmitted if no acknowledgement is received. This is the simplest CSMA method.

The second method is called Carrier Sense, Multiple

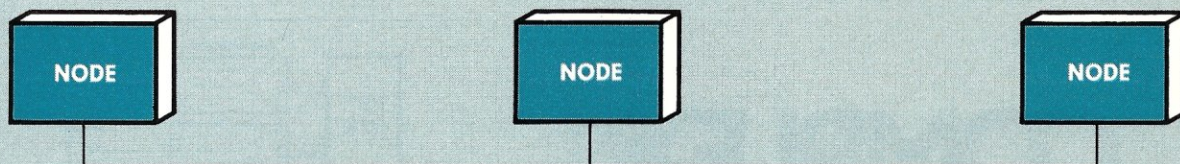


Figure 1. Bus topology.

SIMPLE.

StationMate.™ For uncomplicated computer connections.

Creating a micro and mini computer network has been costly and confusing. Communications hierarchy has prevented many types and various kinds of equipment from sharing information. Until now.

Introducing StationMate. One unit that joins mini computers, micro computers, terminals, and printers. It's transparent. So different brands and types of computers and peripherals can easily interface. StationMate allows you to construct a comprehensive communications network. *Inexpensively.*

Users can select the information they need from the unit they want. StationMate can address any port in the network either by its assigned digital code or by its common identifying name. So everyone has access to all the local or remote computers, mass storage files, and peripheral devices connected in the network. *Immediately.*

StationMate provides local area networking with XLAN™, the simple communications concept from Complexx. All you need is StationMate and an inexpensive shielded-pair cable.

Besides local area networking, StationMate permits access to remote workstations via an internal dial-up modem. And it serves as a gateway for teleprocessing access to all LAN resources. You couldn't get all of this in one unit. Until now. And the suggested retail price is only \$1450.00. StationMate makes communications simple. *Incredibly.*

StationMate. The link you've been missing.

See your local dealer or contact Complexx for the name of the dealer or distributor nearest you.

Complexx Systems, Inc., 4930 Research Drive,
Huntsville, AL 35805. 205/830-4310.

COMPLEXTM

CIRCLE 51 ON READER SERVICE CARD

*The Source is a registered trademark of the Source Telecomputing Company, a subsidiary of the Reader's Digest Association.

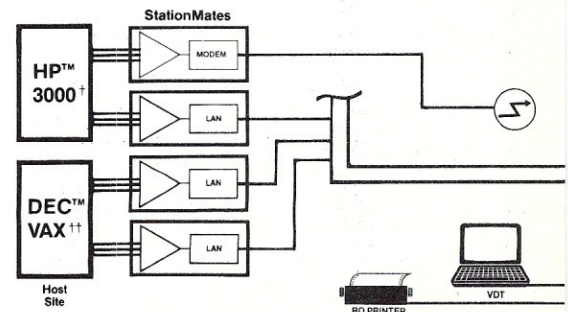
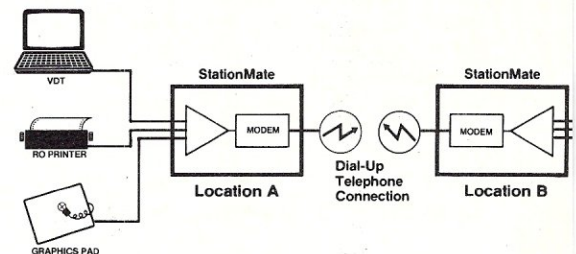
**Dow Jones News/Retrieval is a registered trademark of Dow Jones & Company, Inc.

†HP 3000 is a registered trademark of Hewlett Packard.

††DEC VAX is a registered trademark of Digital Equipment Corporation.

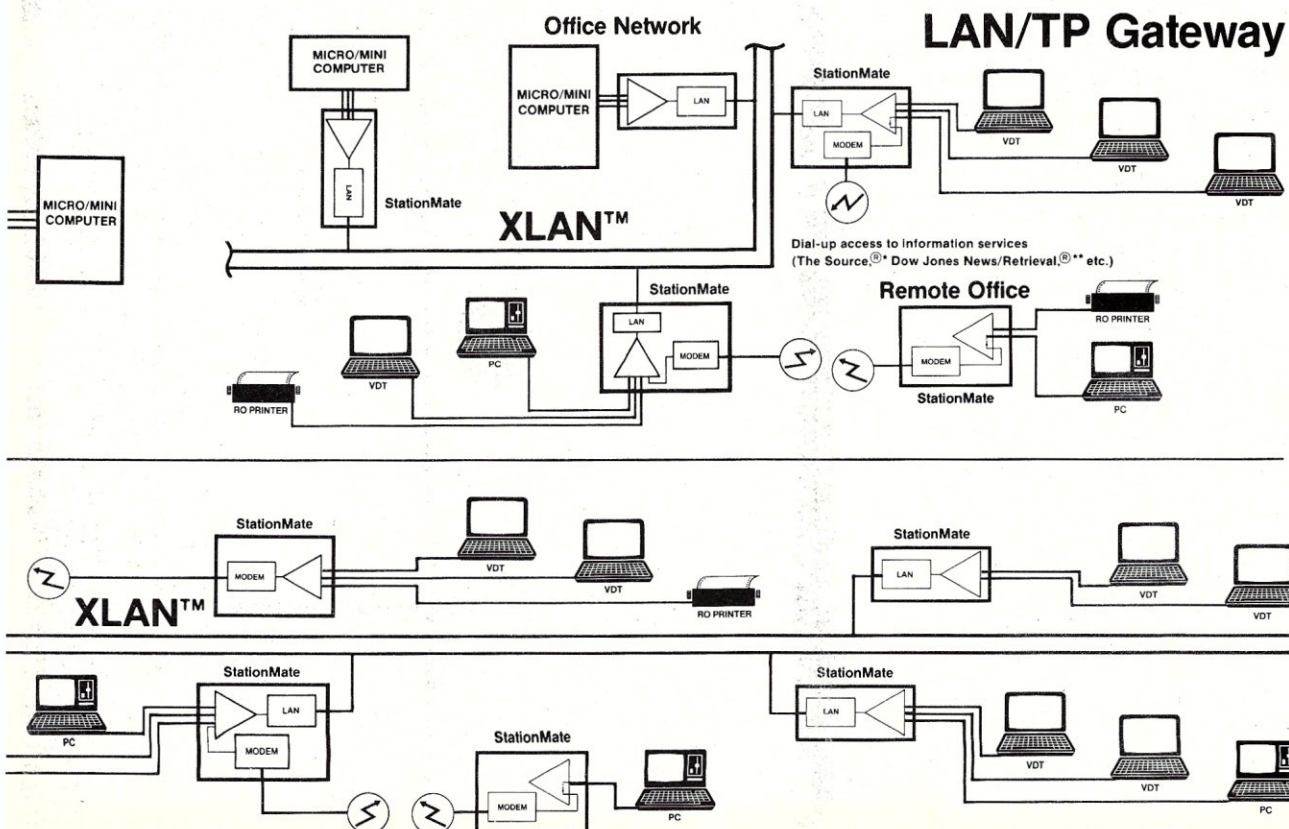
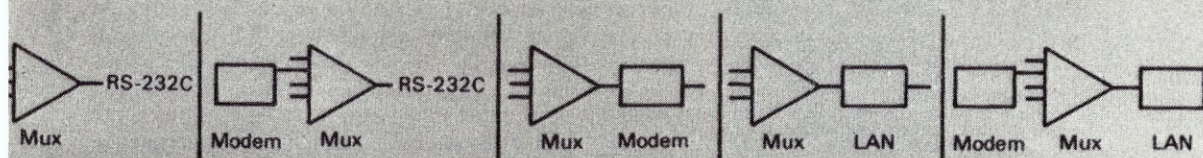


Teleprocessing



Local Networking

LAN Micro Communications System



Access/Collision Detection (CSMA/CD). In this case, each node will listen to the link while it sends its message. The message will be aborted (by sending a special abort sequence) if the message heard on the link does not match the one being sent. The advantage of this method over the CSMA/CA is that garbled messages will be terminated as soon a collision is detected. The CSMA/CA wastes time by continuing to send information after a collision has oc-

curred. The additional collision detection hardware usually adds to the cost of the network interface. The CSMA/CD method normally includes a random delay period before retransmission of a message is started, to prevent the same two nodes from repeating the process.

The advantage of the CSMA methods are that bursty message traffic from nodes is handled in an efficient manner. It is also very easy to add an active node to the network, since any node can send information after checking to the communications link. The disadvantages include the lack of priority control, a nondeterministic maximum message delay time, and less than maximum utilization of the communication link bandwidth, although the utilization can approach the optimal. It is theoretically possible for one node to wait forever to send a message, but this does not happen in practice. In fact, the typical maximum message delay time is usually low if the communication link utilization is less than 50 percent.

On a Bus topology, the type of bus technology used further complicates the decision on the best access method to use. The two possibilities are baseband and broadband. Baseband indicates that a single physical communications link can be used for one message at a time. A broadband system allows a single physical link to be used for more than one message at a time. This is achieved by frequency multiplexing. Different messages are sent on different

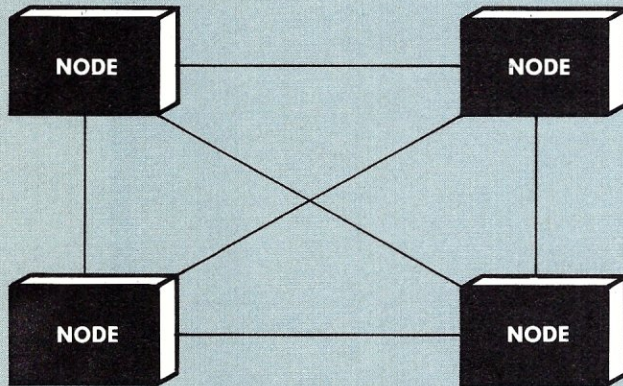


Figure 2. Fully connected point-to-point.

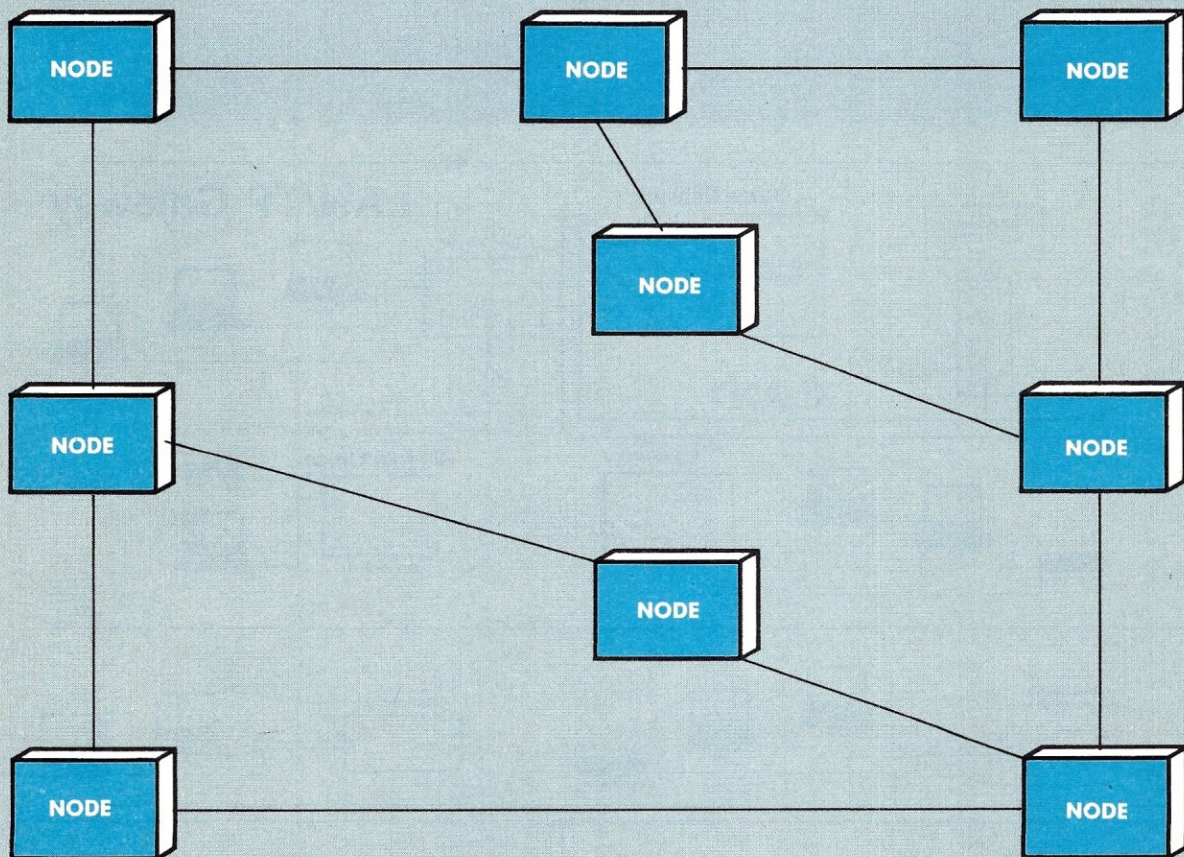
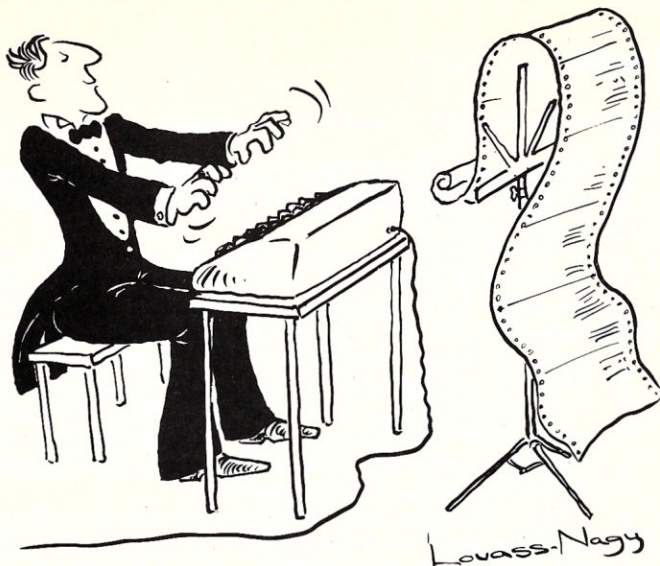


Figure 3. Irregular point-to-point topology.



•NEW PRODUCTS•

Before Johann Sebastian Bach developed a new method of tuning, you had to change instruments practically every time you wanted to change keys. Very difficult.

Before Avocet introduced its family of cross-assemblers, developing micro-processor software was much the same. You needed a separate development system for practically every type of processor. Very difficult and very expensive.

But with Avocet's cross-assemblers, a single computer can develop software for virtually any microprocessor! Does that put us in a league with Bach? You decide.

The Well-Tempered Cross-Assembler

Development Tools That Work

Avocet cross-assemblers are fast, reliable and user-proven in over 3 years of actual use. Ask NASA, IBM, XEROX or the hundreds of other organizations that use them. Every time you see a new microprocessor-based product, there's a good chance it was developed with Avocet cross-assemblers.

Avocet cross-assemblers are easy to use. They run on any computer with CP/M* and process assembly language for the most popular microprocessor families.

5 1/4" disk formats available at no extra cost include Osborne, Xerox, H-P, IBM PC, Kaypro, North Star, Zenith, Televideo, Otrona, DEC.

Turn Your Computer Into A Complete Development System

Of course, there's more. Avocet has the tools you need from start to finish to enter, assemble and test your software and finally cast it in EPROM:

Text Editor VEDIT -- full-screen text editor by CompuView. Makes source code entry a snap. Full-screen text editing, plus TECO-like macro facility for repetitive tasks. Pre-configured for over 40 terminals and personal computers as well as in user-configurable form.

CP/M-80 version \$150
CP/M-86 or MDOS version \$195
(when ordered with any Avocet product)

EPROM Programmer -- Model 7128 EPROM Programmer by GTek programs most EPROMS without the need for personality modules. Self-contained power supply ... accepts ASCII commands and data from any computer through RS 232 serial interface. Cross-assembler hex object files can be down-loaded directly. Commands include verify and read, as well as partial programming.

PROM types supported: 2508, 2758, 2516, 2716, 2532, 2732, 2732A, 27C32, MCM8766, 2564, 2764, 27C64, 27128, 8748, 8741, 8749, 8742, 8751, 8755, plus Seeq and Xicor EEPROMS.

Avocet Cross-assembler	Target Microprocessor	CP/M-80 Version	•CP/M-86 IBM PC, MSDOS** Versions•
•XASMZ80	Z-80	\$200.00 each	\$250.00 each
•XASM85	8085		
XASM05	6805		
XASM09	6809		
XASM18	1802		
XASM48	8048/8041		
XASM51	8051		
XASM65	6502		
XASM68	6800/01		
XASMZ8	Z8		
XASMF8	F8/3870		\$300.00 each
XASM400	COP400		
XASM75	NEC 7500	\$500.00	
Coming soon: XASM68K...68000			

(Upgrade kits will be available for new PROM types as they are introduced.)

Programmer \$389

Options include:

- Software Driver Package --
- enhanced features, no installation required.
- CP/M-80 Version \$ 75
- IBM PC Version \$ 95
- RS 232 Cable \$ 30
- 8748 family socket adaptor ... \$ 98
- 8751 family socket adaptor ... \$174
- 8755 family socket adaptor ... \$135

- **G7228 Programmer by GTek** -- baud
- to 2400 ... superfast, adaptive program-
- ming algorithms ... programs 2764 in one
- minute.

• Programmer \$499

- Ask us about Gang and PAL programmers.

- **HEXTRAN Universal HEX File Converter** -- Converts to and from Intel,
- Motorola, MOS Technology, Mostek,
- RCA, Fairchild, Tektronix, Texas
- Instruments and Binary formats.

- Converter, each version \$250

Call Us

If you're thinking about development systems, call us for some straight talk. If we don't have what you need, we'll help you find out who does. If you like, we'll even talk about Bach.


CALL TOLL FREE 1-800-448-8500

(In the U.S. except Alaska and Hawaii)

VISA and Mastercard accepted. All popular disc formats now available -- please specify. Prices do not include shipping and handling -- call for exact quotes. OEM INQUIRIES INVITED.

*Trademark of Digital Research

**Trademark of Microsoft



**AVOCET
SYSTEMS INC.™**

DEPT.1183M
804 SOUTH STATE STREET
DOVER, DELAWARE 19901
302-734-0151 TELEX 467210

channels that do not interfere with each other. A channel is a range of frequencies that does not overlap those of another channel. Television channels are a good example of a broadband channel. In fact, broadband systems use technology from the cable attached television (CATV) systems. The broadband systems have the advantage of higher data-transfer rates, the ability to send voice, video, and data on different channels, and the ability to use different access methods on different channels. The disadvantage is that the system cost and complexity are significantly higher than those of baseband systems.

Protocols. Finally, there are the network protocols that are used on the communication link once the communication link has been accessed. Protocols address the message format and the message exchange procedures. Message format protocols can be divided into byte-oriented and bit-oriented protocols. These differ primarily in the way the data portion of the message is handled.

The bit-oriented protocols are usually based on the High Level Data Link (HDLC) protocol, of which the Synchronous Data Link Control (SDLC) protocol is a subset. SDLC is the bit-oriented protocols for IBM's Systems Network Architecture (SNA). The bit-oriented protocols use a special bit sequence to indicate the idle state (in which no message is being sent), and a special flag sequence indicating the start of a message. A technique known as "bit-stuffing" is used to keep any data from looking like either a flag or an idle sequence. A message usually has the following parts:

1. Flag indicating the start of a message
2. Destination address
3. Control information
4. Data which may include the source address
5. Error detection information such as a cyclic redundancy check (CRC) item
6. Flag indicating the end of a message

The destination address and control information consist of one or more bytes; the CRC is usually two bytes; and the

flag is a special bit sequence. The data section can be any number of bits and is usually not restricted to an integral number of bytes.

Byte-oriented protocols do restrict the data section to an integral number of bytes, and there is normally a special procedure for sending arbitrary binary data, since the flag sequence and CRC information are specially encoded bytes. A typical example of a byte-oriented protocol is IBM's Bisynch protocol. Special bytes are used to indicate the end of the data section. Multibyte sequences are used to send binary data that is the same as the special bytes. Alternative systems use either a fixed size or additional bytes indicating the size of the data section.

More confusion will be introduced as the nice set of topologies, access methods, and protocols are mixed together into some sample networks and viewed from different vantage points. The first view is how the nodes are positioned, the second is how the nodes are connected by the communication link, and the third is how the protocol and access methods work.

The simplest case is where the view of the system is always a bus, always a ring, and so on. Unfortunately, the number of other combinations is very large, and many of them are useful and practical implementations. For example, the nodes may be positioned in a daisy-chain mode, while the communications link forms a bus. Finally, the token-passing access method is used, forming a logical ring. Figure 10 shows this structure.

And just to show that this is not a fluke, one of the proposed IBM LAN implementations uses a token-passing access method with a ring communication link and a star topology with respect to the node positions, as shown in Figure 11.

The token-passing view is the ring that matches the connection view of the communication link. The reason for using this architecture is that the central node would have special connectors that would know when a node is not connected (either logically or physically) and close the

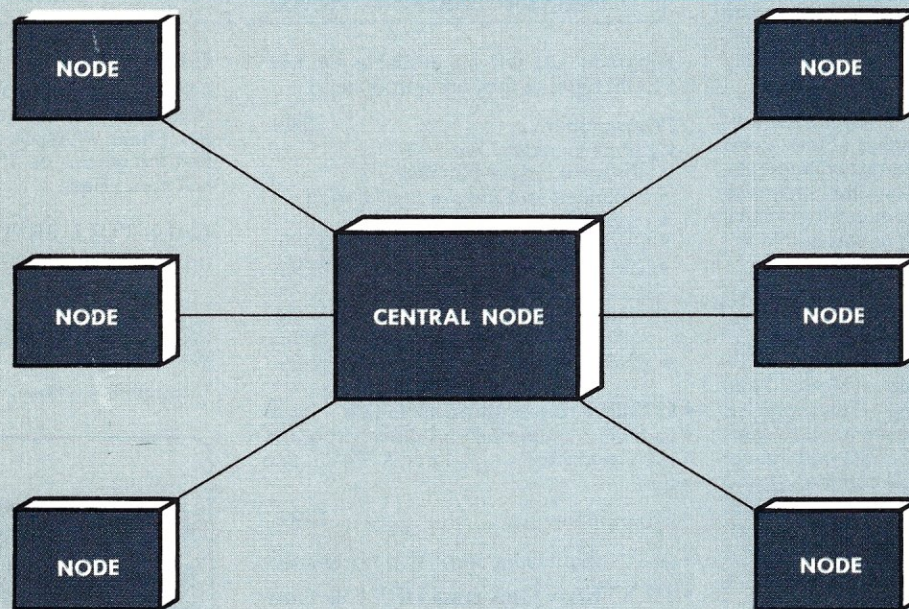


Figure 4. Star topology.

FORTH for Z-80[®] , 8086, 68000, and IBM[®] PC

FORTH Application Development Systems include interpreter/compiler with virtual memory management and multi-tasking, assembler, full screen editor, decompiler, utilities, and 130+ page manual. Standard random access files used for screen storage, extensions provided for access to all operating system functions.

Z-80 FORTH for CP/M [®] 2.2 or MP/M II	\$ 50.00
8080 FORTH for CP/M 2.2 or MP/M II	\$ 50.00
8086 FORTH for CP/M-86 or MS-DOS	\$100.00
PC/FORTH[™] for PC-DOS, CP/M-86, or CCPM	\$100.00
68000 FORTH for CP/M-68K	\$250.00

83 - Standard version of all application development systems available soon. All registered users will be entitled to software update at nominal cost.

FORTH + Systems are 32 bit implementations that allow creation of programs as large as 1 megabyte. The entire memory address space of the 68000 or 8086/88 is supported directly for programs and data.

PC/FORTH + for PC-DOS or CP/M-86	\$250.00
8086 FORTH + for CP/M-86	\$250.00
68000 FORTH + for CP/M-68K	\$400.00

Extension Packages for FORTH systems

Software floating point (Z-80, 8086, PC only)	\$100.00
Intel 8087 support (8086, PC only)	\$100.00
AMD 9511 support (8086, Z-80 only)	\$100.00
Color graphics with animation support (PC only)	\$100.00
Symbolic interactive debugger (PC only)	\$100.00
Cross reference utility	\$ 25.00
PC/GEN [™] (custom character sets, PC only)	\$ 50.00
PC/TERM communications program for PC and Smartmodem	\$ 60.00
Hierarchical file manager	\$ 50.00
B-tree index manager	\$125.00
B-tree index and file manager	\$200.00

QTF + Screen editor and text formatter by Leo Brodie,
for IBM PC with IBM or Epson printer

Nautilus Cross Compiler allows you to expand or modify the FORTH nucleus, recompile on a host computer for a different target computer, generate headerless and ROMable code. Supports forward referencing. Produces executable image in RAM or disk file. No license fee for applications. Prerequisite: Application Development System for host computer.

Hosts: Z-80 (CP/M 2.2 or MP/M II), 8086/88 (CP/M-86 or MS-DOS), IBM PC (PC-DOS or CP/M-86), 68000 (CP/M-68K)
Targets: 8080, Z-80, 8086/88, 6502, LSI-11, 68000, 1802, Z-8

Cross-Compiler for one host and one target	\$300.00
Each additional target	\$100.00

AUGUSTA[™] ADA subset compiler from Computer Linguistics, for Z-80 computers under CP/M 2.2

LEARNING FORTH computer-assisted tutorial by Laxen and Harris for CP/M, includes Brodie's
"Starting FORTH" (8" format only)

Z-80 Machine Tests Memory, disk, printer, and console tests with all source code in standard Zilog
mnemonics

8080 and Z-80 application development systems require 48 kbytes RAM and 1 disk drive, 8086 and 68000 require 64 kbytes. Prices include shipping by UPS or first class mail within USA and Canada. California residents add appropriate sales tax. Purchase orders accepted at our discretion. Master Charge and Visa accepted.

Disk formats available: Standard CP/M 8" SSD, Northstar 5 1/4" QD, Micropolis 5 1/4" QD, Sage 5 1/4" DD, Apple 5 1/4", Victor 9000 5 1/4", Kaypro 5 1/4", Osborne 5 1/4" DD, Micromate 5 1/4", IBM PC 5 1/4", Standard MS-DOS 5 1/4" SSD. Most other formats can be special ordered.

Laboratory Microsystems, Inc.
4147 Beethoven Street
Los Angeles, CA 90066
(213) 306-7412

Z-80 is a registered trademark of Zilog, Inc.

CP/M is a registered trademark of Digital Research, Inc.

IBM is a registered trademark of International Business Machines Corp.

Augusta is a trademark of Computer Linguistics

dBASE II is a trademark of Ashton-Tate

PC/FORTH and PC/GEN are trademarks of Laboratory Microsystems Inc.

CIRCLE 26 ON READER SERVICE CARD

ring. This prevents the failure of the entire system if either a node or a communication link fails; nevertheless, a failure in the central node still causes the entire communications network to become inoperative.

Network standards

The IEEE 802 committee is currently working on standards for the Data Link and Physical Layers of the ISO network model. The standards are based upon the Bus and Ring topologies for the communication link. CSMA/CD and token passing are the two access methods being defined in conjunction with these topologies. Table 1 shows a summary of the committee's recommendations. The channel size on the broadband systems indicates the bandwidth of one channel on the communications link.

Notice that the three basic standards (P802.3, P802.4,

and P802.5) define a range of implementations in terms of transmission speed and connection media. The standards follow existing implementations when possible. For example, the CSMA/CD bus implementation by Xerox is called Ethernet, and this essentially matches the P802.3 standard with a baseband, coaxial design running at 10 megabits per second (Mbps). Ethernet is a de facto industry standard baseband LAN that is implemented by a number of vendors other than Xerox.

Standards already exist for the point-to-point communication links. These include the Electronic Institute of America (EIA) standards such as the famous RS-2320 standard, and the RS-422 and RS-423 standards. The current set of standards deal with the lowest levels of the ISO model. The next section deals with some of the services that may be provided at the higher levels, even though standards do not exist in these areas.

Node services

The purpose of a LAN is to provide the communications link between the nodes within a LAN so nodes can provide services and resources to other nodes within the LAN. Some of the generic names given to services that can be provided by nodes in a LAN are:

1. User interface
2. Computational server
3. File server
4. Print server
5. Communication server
6. Gateway server

A node in a LAN may provide one or more of these services to users at the node or other nodes within the LAN, depending upon the implementation. The term "server" is often interchanged with "node" when a node provides only that service: e.g., computational server and computational node. Other terms are used to refer to combinations of services provided at a node.

The use interface is typically a keyboard and display or

Table 1. IEEE 802 Committee Recommendations

1. CSMA/CD (P802.3)
 - a. Baseband coaxial cable (1, 5, 10, 20 Mbps)
 - b. Broadband (10 Mbps, 6 MHz channel)
2. Token passing
 - a. Bus (P802.4)
 1. Baseband
 - a. Phase continuous coaxial cable (1 Mbps)
 - b. Phase coherent coaxial cable (5, 10 Mbps)
 2. Broadband
 - a. 1.544 Mbps (4, 6 MHz channel)
 - b. 5 and 10 Mbps (6 MHz channel)
 - c. 10 and 20 Mbps (12 MHz channel)
 - b. Ring (P802.5)
 1. Baseband shielded twisted pair (1.4 Mbps)
 2. Broadband coaxial cable (4, 20, 40 Mbps)

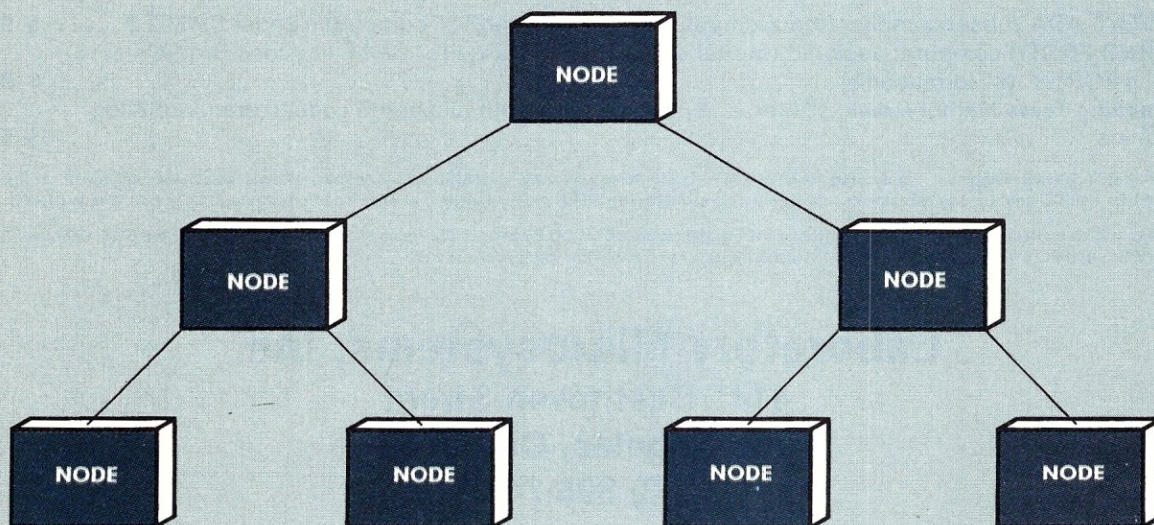


Figure 5. Tree topology.

INTRODUCING MODULA2

MODULA-2:

BY WIRTH, FROM JRT, FOR CP/M.*

1970: Swiss professor, Nicklaus Wirth, designed Pascal.

1981: Prof. Wirth designed Modula-2. Evolved from 12 year's Pascal experience, new Modula-2 proves even more powerful, concise and easy-to-learn than Pascal.

1983: JRT Systems, Inc. makes this latest microcomputer language available for your CP/M system.

MODULA-2: BEYOND PASCAL.

This new language *refines* Pascal's *syntax* and adds:

—The **MODULE** concept—similar to Pascal's external procedures, but much more flexible—to allow development of very large programs.

Build up a *program module library* as common modules can be used for many programs—and modified without changing entire programs. The compiler does type checking across modules to make sure they correctly reference each other.

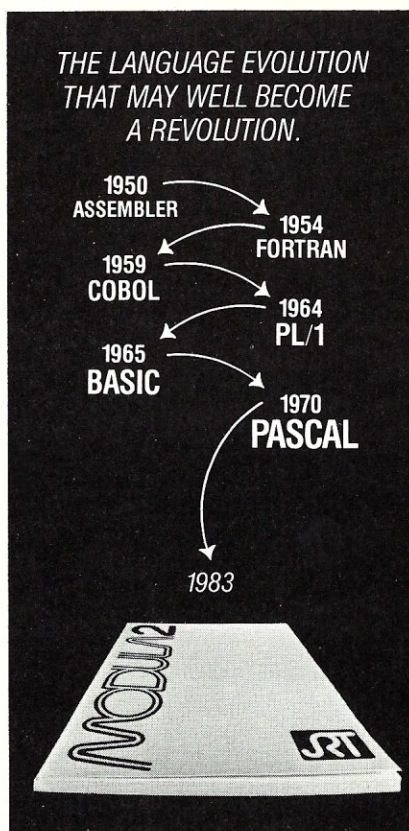
—The **PROCESS** concept for multi-programming capability. Modula-2 supports advanced multiprogramming concepts such as process creation, monitors, signals.

—**PROCEDURE VARIABLES** for new possibilities in program control.

—**LOW-LEVEL FACILITIES** for direct control over your computer hardware.

And there's much, much more. Your payoff is easier, more flexible, more productive programming.

THE LANGUAGE EVOLUTION
THAT MAY WELL BECOME
A REVOLUTION.



Experience proves:
the more modern the language,
the more productive the programmer.
Modula 2: the most modern language.

MODULA-2: BYTE, JUNE 1983.

About an early Modula-2, the reviewer wrote:

"...I've had a Modula-2 compiler for more than a month now, and I'm still in love. I'll make this flat prediction: *this language is going to be one of the most important of this century...*"
"...it's as easy to read and understand as Pascal..." (Our italics.)

CIRCLE 94 ON READER SERVICE CARD

MODULA-2: FOR PROGRAMMERS,
NEW POSSIBILITIES—
FOR DEVELOPERS, NEW MARKETS.

Whether you demand state-of-the-art language software for your work, business or pleasure, JRT Modula-2 is the next step. Take that step today; join the revolution.

Just send the coupon, or call.

JRT MODULA-2....
\$99.95

JRT Systems include:
manual, 8" or 5 1/4" diskette, and postage paid within North America. In the boxes provided, specify the diskette format you need. A 60K CP/M system is required; *CP/M is a Digital Research TM.

PLEASE SEND ME:

☐ 8" SSSD diskette ☐ 5 1/4" diskette for ☐ Apple, CP/M ☐ Kaypro ☐ Manual only ☐ Osborne 19.95

☐ Check ☐ C.O.D. (add \$5)
☐ VISA ☐ MasterCard ☐ American Express
(California residents add 6% Sales Tax. Outside North America, add \$15. Checks must be on a U.S. bank, and in U.S. dollars.)

CARD # _____ EXP. _____

SIGNATURE _____

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

Phone toll-free

800-932-3320

(In California, 800-433-7519. These toll-free numbers are for orders only. For service, phone 415-388-0530.)



JRT Systems, Inc.
45 Camino Alto / C4
Mill Valley, CA 94941

Dealer inquiries invited

**JRT products will be available for the IBM/PC
in PC-DOS and CP/M-86 formats
about January 1, 1984.**

printer. It is often combined with other services in the form of a personal computer, or it may be a simple computer terminal which must be logically attached to other servers in the LAN. In either case, the purpose is to allow a user to enter information and receive results.

A computational server is the usual computer, less peripheral interfaces. It consists of a processing unit and memory. This is where programs initiated by a user are run. Typical programs include applications such as order entry, program compilation, and word processing. Diskless workstations in a LAN often include a user interface and a computational server. Note that the memory in a computational server is usually small and volatile in comparison to that of a file server, and therefore not suitable for long-term storage.

The file server provides the memory function for large amounts of data over long periods of time. A file server usually manages resources consisting of a hard disk and corresponding backup facility. The way the file server manages these resources can differ significantly, depending upon implementation. Any file server implementation can usually be categorized as one of the following:

1. Partitioned file server
2. Shared file server
3. Data base server

A partitioned file server (Figure 12) divides its resource into one or more partitions. A node can access a partition and the files within the partition; however, another node

cannot access the same partition at the same time unless all parties are allowed read-only access. This is the implementation normally used for LANs which have simple but different operating systems running on the computational servers. A partition is usually allocated to only one of the operating systems at a time. The advantage is that the hard disk resource and associated backup can be shared among a number of nodes running different operating systems. The disadvantage is that running a shared data base is difficult, since controlled simultaneous access and update by many nodes is not possible.

A shared file server (Figure 13) may divide the hard disk into a number of partitions, but the files within a partition can be accessed and updated in a controlled fashion by different nodes at the same time. This usually requires that a more sophisticated operating system be run in the computational servers, with additional sophistication in the file server. Typical implementations usually restrict the computational servers to the same operating system. A good example would be the CP/NET system from Digital Research. A mix of different operating system partitions on a shared file server is theoretically possible; however, such implementations do not currently exist.

The data base server (Figure 14) is a more complex animal than the previous file servers mentioned. These presented a file system to the computational servers which could be manipulated by programs; however, any data base operations would have to be done by the computa-

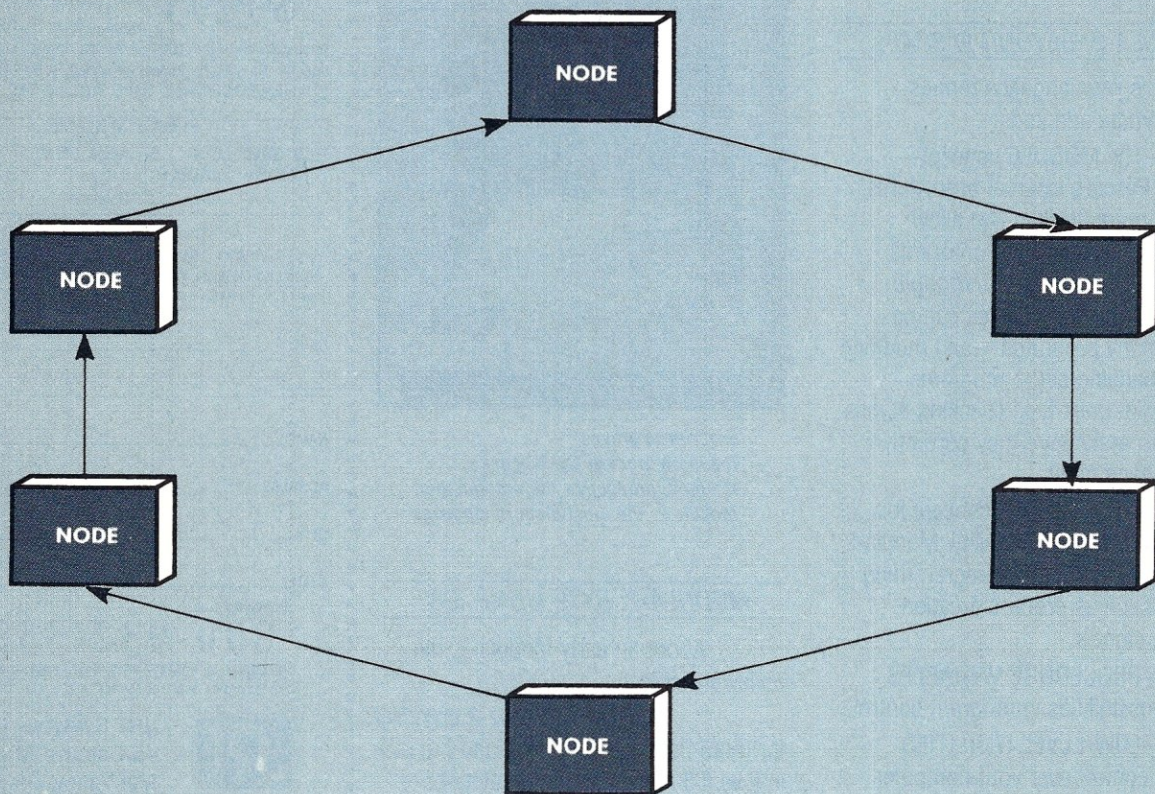


Figure 6. Ring topology.



Retail Sales

123 East 200 South
Salt Lake City, Utah 84102

The Great Salt Lake Computer Company, Inc.

Mail Orders

P.O. Box 3150
Salt Lake City, Utah 84110



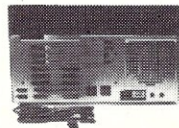
QT 5 1/4" MAINFRAME



- Provisions for any 2 - 5 1/4" drives • 15 ea DB 25 cutout
- 2 ea 50 pin • 2 ea 34 pin • 1 ea Centronic • EMI filter (fused)
- 2 AC outlets • Avbl. with 6 - 8 or 12 slot motherbd •
- Power supply (+8V16A/+16V3A/+12V5A)

QTC-MF + MD8 (8 slot MB) \$520.00
QTC-MF + MD12 (12 slot MB) \$560.00

QT 8" MAINFRAME



- Provision for any 2 - 8" drives (hard or floppy) • 15 ea DB 25 cutout • 2 ea 50 pin • 2 ea 34 pin • 1 ea Centronic • EMI filter (fused) • 2 AC outlets • Avbl. with 6 - 8 or 12 slot motherbd
- Power supply (+8V16A/+16V3A/+5V6A/-5V1A/+24V6A)

Desk Top Version
QTC-MF + DD8 \$625.00
QTC-MF + DD12 \$675.00

QT STANDARD MAINFRAME

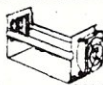
- Provisions for any 2 - 5 1/4" drives
- 15 ea DB 25 cutout • 2 ea 50 pin
- 2 ea 34 pin • 1 ea Centronic
- EMI filter (fused) • 2 AC outlets
- Avbl. with 6-8-12-18 or 22 slot MB
- Power supply (+8V16A/+16V3A)



Desk Top Version
QTC-MF + 12 \$499.00
QTC-MF + 18 \$525.00
QTC-MF + 22 \$550.00

QT S-100 CARD CAGES

- Made of anodized steel • Card guides for ea. MB • 1 - Indicates w/MB
- 2 - Indicates w/MB + 1 ea fan
- 3 - Indicates w/MB + 2 ea fans



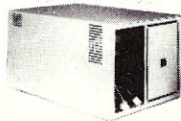
QTC-CC4	\$20.00	CC12	\$41.00
CC4-1	\$60.00	CC12-1	\$140.00
CC6	\$22.00	CC12-2	\$160.00
CC6-1	\$70.00	CC12-3	\$180.00
CC6-2	\$90.00	CC18	\$50.00
CC8	\$31.00	CC18-1	\$200.00
CC8-1	\$100.00	CC18-2	\$220.00
CC8-2	\$120.00	CC18-3	\$240.00
		CC22	\$75.00

QT S-100 MOTHERBOARDS

- Silence Plus • Built in Termination • IEE696 • Terminal strip for easy power connection

4 Slot Motherboards	6 Slot Motherboards
QTC-MB4BB \$15.00	QTC-MB6BB \$20.00
QTC-MB4A \$40.00	QTC-MB6A \$48.00
8 Slot Motherboards	12 Slot Motherboards
QTC-MB8BB \$25.00	QTC-MB12BB \$30.00
QTC-MB8A \$69.00	QTC-MB12A \$99.00
18 Slot Motherboards	22 Slot Motherboards
QTC-MB18BB \$45.00	QTC-MB22BB \$60.00
QTC-MB18A \$150.00	QTC-MB22A \$185.00

QT 8" THINLINE MAINFRAME



- Provisions for 2 ea 8" thinline drives • 15 ea DB 25 cutout
- 2 ea 50 pin • 2 ea 34 pin • 1 ea Centronic
- EMI filter (fused) • 2 AC outlets
- Power supply (+8V16A/-5V/+24V6A+5V6A)

QTC-IMF + DD6F (6 slot MB) \$350.00

DISK DRIVES / DRIVE SUB ASSEMBLY

8" Disk Drives

801R Shugart SS/DD \$359.00
851R Shugart DS/DD \$479.00
DT8 (842) Oume DS/DD \$490.00
BEST M-2694-63 MIT DS/DD \$389.00
BUY (Call for qty price)
M-2896-63 MIT 8" thinline DS/DD \$399.00

5 1/4" Disk Drives

TM100-1 or B-51 for IBM \$150.00
TM100-2 or B-52 for IBM (In stock) \$225.00

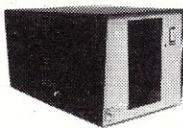
- Vertical or horizontal disk cabinet-11" h x 11" w x 20" d
- 5" h x 17" w x 20" d

QTC-DDS + 0 w/2 ea SS/DD Siemens drives \$595.00
QTC-DDS + 1 w/1 ea DS/DD MIT 2894-63 \$695.00
QTC-DDS + 2 w/2 ea DS/DD MIT 2894-63 \$1075.00
QTC-DDS + 3 w/2 ea SS/DD 801R Shugart \$975.00
QTC-DDS + 4 w/2 ea DS/DD 8" thinline drives \$1150.00

OUR SALTIER DEALS

Toshiba P-135
100 cps letter quality 200 cps reg. mode
Par or serial-full graphics-24 pin printhead \$1499.00
Bi-directional tractor \$210.00
Sheet feeder \$1095.00

QT DISK DRIVE CABINETS



"All in One" Vertical Disk Drive Cabinet

For 1) 2 ea or 4 ea 8" thinline drive
2) 2 ea standard 8" drives
3) 1 ea hard disk + 1 ea standard 8"
• Power supply (+5V6A/-5V1A/+24V6A)
• Positive pressure fan w/filter • EMI filter
• Power interface cable for any 8" drive
QTC-DDC88V For 2 standard size 8" drives \$269.00
QTC-DDC88T For 2 thinline 8" drives \$269.00
QTC-DD8V For 1 ea 8" drive \$249.00

Horizontal Disk Drive Cabinet

For 2 ea 8" standard size drives
• Power supply (+5V6A/-5V1A/+24V6A)
• Interface cable for any 8" drive
QTC-DDC88H \$269.00

TERMINALS / MONITORS

Televideo 925C \$715.00
Televideo 970 \$1095.00
Sanyo 2112A (15MHz) Green \$80.00
Princeton HX-12RGB (For IBM) \$489.00

PARTS

TR1602B \$2.50 ea. TM2716(5 + 12V) \$3.95 ea.
2114L2 \$1.50 ea. 2732 \$4.95 ea.
TMS2532 \$5.95 ea. 4164(200NS) \$5.95 ea.
2716 (5V) \$3.95 ea. TMS6116-4(150NS) \$5.00 ea.

MANY OTHERS IN STOCK

SIERRA DATA S-100 BOARDS

SDS-SBC-100-Z80 (4mhz) master 2 serial
2 par/floppy controller/64k ram \$675.00
SDS-SBC-100S4mhz slave/2 serial
2 par/64k ram \$625.00
SDS-ZSIO/4-4 serial port I/O bd \$250.00
SDS-MUX-RS232 multiplexer bd \$235.00
SDS-HDI-M-Hard disk bd for micropolis \$129.00
SDS-CPM/B105-cp/m for SBC100 w/BIOS \$150.00
SDS-Turbodos-Multi-user for master & slaves \$645.00

PRINTERS

Star-Gemini 10 CALL
OK1-82A (120 cps) Serial + par \$379.00
OK1-83A (120 cps) Serial + par \$629.00
OK1-84A (200 cps) Serial \$1059.00
OK1-82A (160 cps) \$489.00
OK1-93A (160 cps) \$799.00
NEC-8023A \$389.00

BOARD SETS

Best Bare Board Set Available

QTC-SBC 2/4 CPU
QTC-EXP + III 256K Memory bd.
QTC-FDC 5/8 Floppy disk controller
Bare Board Set \$150.00
1) Includes manuals & assembly instructions
2) Parts available 3) Monitor & BIOS available

QT CLOCK/CALENDAR

S-100 or Apple • Time in hrs, min, sec. • AM/PM or Military
Format • Date in Mo., Day, Yr, Day of Week & Leap Year
recognition • 4 hard interrupts (1024 Hz, 1Hz, 1 min, 1 hr)
• On board battery (will last 14 mos. w/no power on)

QTC-CCS-BB (S-100) \$45.00
QTC-CCS-A (A + T) for S-100 \$95.00

CPU BOARDS / MEMORY BOARDS / I/O

QTC-SBC 2/4 BB \$50.00
QTC-SBC 2/4 A + T \$265.00
QTC-Z + 80 BB \$28.00

DYNAMIC (64K/256K or 1 MEG)

QTC-EXP + III Bare Bd. \$65.00
QTC-EXP + III 64K A + T \$450.00

QTC-I/O + BB 2 SER 2 PAR A + T \$60.00
QTC-I/O + A + T \$340.00
QTC-ADA ADA Converter A + T \$375.00
QTC-Dual GPIB-488 IEEE 488 Interface bd. A + T \$475.00

APPLE CORNER / DISKETTES

Micro-SCI Drive \$225.00
w/controller add \$70.00
Rana Elite I \$249.00
Rana Elite II \$399.00
Rana Elite III \$509.00
Rana Controller \$85.00
QT Apple Compatible Drive \$209.00
5 1/4" soft sector (for Apple) \$18.00 for 10
1 yr. warranty-with hub ring
5 1/4" soft sector DS/DD \$24.00 for 10
5 1/4" plastic library case \$2.50 ea., \$20.00 for 10
Flip file storage case (stores 50 diskettes) \$27.95
Flip File "Original 5" (holds 50) \$21.00
Flip File "Original 8" (holds 50) \$29.95

In Continental U.S.
TOLL FREE (800) 545-2633

Inside Utah
(801) 363-3314

We accept cash, checks, credit cards, or Purchase Orders from qualified firms and institutions. Minimum prepaid order \$15.00. Export customers outside the U.S. or Canada please add 10% to all prices. Prices and availability subject to change without notice. Shipping and handling charges via UPS Ground 60c/lb. UPS Air \$1.00/lb. minimum charge \$3.00.

CIRCLE 39 ON READER SERVICE CARD

tional server which must also control the integrity of the data base through the use of file and record locks. The data base server relieves the computational server of this work by preserving data base integrity itself. This higher level interface allows different operating systems and language access to a common data base. The advantage of such a system is its power and flexibility, but there is a significant increase in complexity and cost—which is why data base servers are currently used only in the more expensive systems.

A print server is an interesting system which provides a printer as a resource. It can be driven by information from a computational server, but a print server configured as a node usually operates in a different fashion. In this case, the print server normally receives requests to print files which reside in a file server. More complex print servers will receive information from other nodes and route it to a file server if the printer is currently in use. The file created will be added to the list of files to be printed. This is called print spooling. A print server allows the resource to be shared efficiently, since the printer will be in constant use if sufficient files exist to be printed.

A communication server and a gateway server are similar animals. They are used to connect a node or LAN to an external node or LAN. A communication server normally implies a connection to the remote system with the node acting as an IBM 3101, IBM 3270 or IBM 3780 terminal. A computational server normally emulates the terminal in

conjunction with the communication server and a user interface. A gateway server allows for a more complex connection between nodes in a LAN and the outside world. In this case a logical link can be made between a node in the LAN and a node outside the LAN, over which communication between the two proceeds as if both nodes were in the same LAN. A communication server requires a node to use the protocol of the terminal being emulated, while the gateway server allows a node to use the LAN protocol.

LAN implementations

This section briefly presents some of the existing hardware and software implementations of various portions of the ISO model. Table 2 gives a larger set of existing implementation in less detail. This is not an exhaustive study, however. Four implementations will be described briefly. These are: Ethernet, Ominet, ARCnet, and CP/NET.

The foremost implementation to date is probably the Xerox Ethernet, which matches the IEEE 802.3 standard (10 Mbps, CSMA/CD, coax bus). The Ethernet specification applies to the Physical and Data Link layers of the ISO model. It has a data rate of 10 million bits per second, a maximum node separation of 2.5 kilometers, up to 1024 nodes, and uses a passive shielded coaxial cable operating with baseband signaling. The passive aspect of the system is important in that no particular node need be active to keep the system running. This, along with the high reliability of coaxial cable, leads to a highly fault-resistant system.

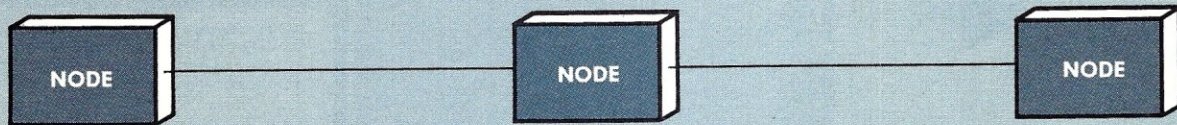


Figure 7. Chain topology.

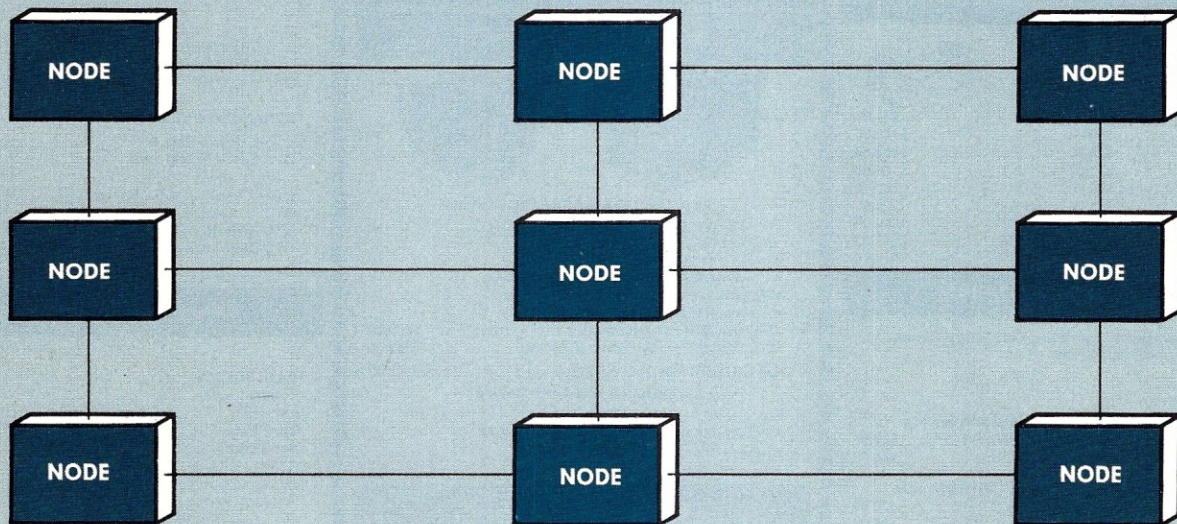


Figure 8. Matrix topology.

Z80 Software

SOFTWARE DESCRIPTIONS

TPM (TPM I) - \$80 A Z80 only operating system which is capable of running CP/M programs. Includes many features not found in CP/M such as independent disk directory partitioning for up to 255 user partitions, space, time and version commands, date and time, create FCB, chain program, direct disk I/O, abbreviated commands and more! Available for North Star (either single or double density), TRS-80 Model I (offset 4200H) or II, Versafloppy I, or Tarbell I.

TPM-II - \$125 An expanded version of TPM which is fully CP/M 2.2 compatible but still retains the extra features our customers have come to depend on. This version is super FAST. Extended density capability allows over 600K per side on an 8" disk. Available preconfigured for Versafloppy II (8" or 5"), Epson QX-10, Osborne II or TRS-80 Model II.

CONFIGURATOR I

This package provides all the necessary programs for customizing TPM for a floppy controller which we do not support. We suggest ordering this on single density (8SD).

Includes: TPM-II (\$125), Sample BIOS (BIOS) SOURCE (\$FREE), MACRO II (\$100), LINKER (\$80), DEBUG I (\$80), QED (\$150), ZEDIT (\$50), TOP I (\$80), BASIC I (\$50) and BASIC II (\$100)

\$815 Value

NOW \$250

CONFIGURATOR II

Includes: TPM-II (\$125), Sample BIOS (BIOS) SOURCE (\$FREE), MACRO II (\$100), MACRO III (\$150), LINKER (\$80), DEBUG I (\$80), DEBUG II (\$100), QED (\$150), ZEDIT (\$50), TOP II (\$100), BUSINESS BASIC (\$200) and MODEM SOURCE (\$40) and DISASSEMBLER (\$80)

\$1485 Value

NOW \$400

MODEL I PROGRAMMER

This package is only for the TRS-80 Model I. Note: These are the ONLY CDL programs available for the Model I. It includes: TPM I (\$80), BUSINESS BASIC (\$200), MACRO I (\$80), DEBUG I (\$80), ZDDT (\$40), ZTEL (\$80), TOP I (\$80) and MODEM (\$40)

\$680 Value

NOW \$175

MODEL II PROGRAMMER

This package is only for the TRS-80 Model II. It includes: TPM-II (\$125), BUSINESS BASIC (\$200), MACRO II (\$100), MACRO III (\$150), LINKER (\$80), DEBUG I (\$80), DEBUG II (\$100), QED (\$150), ZTEL (\$80), TOP II (\$100), ZDDT (\$40), ZAPPLE SOURCE (\$80), MODEM (\$40), MODEM SOURCE (\$40) and DISASSEMBLER (\$80)

\$1445 Value

NOW \$375

BASIC I - \$50, a 12K - basic interpreter with 7 digit precision.

BASIC II - \$100, A 12 digit precision version of Basic I.

BUSINESS BASIC - \$200, A full disk extended basic with random or sequential disk file handling and 12 digit precision (even for TRIG functions). Also includes PRIVACY command to protect source code, fixed and variable record lengths, simultaneous access to multiple disk files, global editing, and more!

ACCOUNTING PACKAGE - \$300, Written in Business Basic. Includes General Ledger, Accounts Receivable/Payable, and Payroll. Set up for Hazeltine 1500 terminal. Minor modifications needed for other terminals. Provided in unprotected source form.

MACRO I - \$80, A Z80/8080 assembler which uses CDL/TDL mnemonics. Handles MACROs and generates relocatable code. Includes 14 conditionals, 16 listing controls, 54 pseudo-ops, 11 arithmetic/logical ops, local and global symbols, linkable module generation, and more!

MACRO II - \$100, An improved version of Macro I with expanded linking capabilities and more listing options. Also internal code has been greatly improved for faster more reliable operation.

MACRO III - \$150, An enhanced version of Macro II. Internal buffers have been increased to achieve a significant improvement in speed of assembly. Additional features include line numbers, cross reference, compressed PRN files, form feeds, page parity, additional pseudo-ops, internal setting of time and date, and expanded assembly-time data entry.

DEVELOPER I

Includes: MACRO I (\$80), DEBUG I (\$80), ZEDIT (\$50), TOP I (\$80), BASIC I (\$50) and BASIC II (\$100)

\$440 Value

NOW \$150

DEVELOPER II

Includes: MACRO II (\$100), MACRO III (\$150), LINKER (\$80), DEBUG I (\$80), DEBUG II (\$100), BUSINESS BASIC (\$200), QED (\$150), TOP II (\$100), ZDDT (\$40), ZAPPLE SOURCE (\$80), MODEM SOURCE (\$40), ZTEL (\$80), and DISASSEMBLER (\$80).

\$1280 Value

NOW \$350

DEVELOPER III

Includes: QAL (\$200), QED (\$150), BUSINESS BASIC (\$200), ZTEL (\$80) and TOP II (\$100)

\$730 Value

NOW \$300

COMBO

Includes: DEVELOPER II (\$1280), ACCOUNTING PACKAGE (\$300), QAL (\$200) and 6502X (\$150)

\$1930 Value

NOW \$500

LINKER - \$80, A linking loader for handling the linkable modules created by the above assemblers.

DEBUG I - \$80, A tool for debugging Z80 or 8080 code. Disassembles to CDL/TDL mnemonics compatible with above assemblers. Traces code even through ROM. Commands include Calculate, Display, Examine, Fill, Goto, List, Mode, Open File, Put, Set Wait, Trace, and Search.

DEBUG II - \$100, A superset of Debug I. Adds instruction Interpreter, Radix change, Set Trap/Conditional display, Trace options, and FCB.

6502X - \$150, A 6502 cross assembler. Runs on the Z80 but assembles 6502 instructions into 6502 object code! Similar features as our Macro assemblers.

QAL - \$200, A SUPER FAST Z80 assembler. Up to 10 times faster than conventional assemblers. Directly generates code into memory in one pass but also to offset for execution in its own memory space. Pascal like structures: repeat, until, if, then, else, while, do, begin, end, case, of. Multiple statements per line, special register handling expressions, long symbol names, auto and modular assembly, and more! This one uses ZILGO Mnemonics.

QED - \$150, A screen editor which is both FAST and easy to learn. Commands include block delete, copy, and move to a named file or within text, repeat previous command, change, locate, find at start of line, and numerous cursor and window movement functions. Works with any CRT having clear screen, addressable cursor, clear to end of line, clear to end of screen, and 80X24.

DISK FORMATS

When ordering software specify which disk format you would like.

CODE	DESCRIPTION
8SD	8" IBM 3740 Single Density (128 bytes/26 sectors/77 tracks)
8DD	8" Double Density (256 bytes/26 sectors/77 tracks)
8XD	8" CDL Extended Density (1024 bytes/8 sectors/77 tracks) 616K)
5SD	5.25" Single Density (TRS80 Model I, Versafloppy I, Tarbell I)
5EP	5.25" Epson Double Density
5PC	5.25" IBM PC Double Density
5XE	5.25" Xerox 820 Single Density
5OS	5.25" Osborne Single Density
5ZA	5.25" Z80 Apple (Softcard compatible)

TPM INFO When ordering TPM I or II, in addition to Disk Format, please specify one of the following codes:

CODE	DESCRIPTION
TPM I:	
NSSD/H	North Star Single Density for Horizon I/O
NSSD/Z	North Star Single Density for Zapple I/O
NSDD/H	North Star Double Density for Horizon I/O
NSDD/Z	North Star Double Density for Zapple I/O
TRS80-I	TRS-80 Model I (4200H Offset)
TRS80-II	TRS-80 Model II
V18	Versafloppy I 8"
V15	Versafloppy I 5.25"
TPM-II:	
V18	Versafloppy II 8" (XD)
V15	Versafloppy II 5.25"
TRS80-II	TRS-80 Model II (XD)

Prices and Specifications subject to change without notice.
TPM, Z80, CP/M, TRS80 are trademarks of CDL, Zilog, DRI and Tandy respectively.

ZTEL - \$80, An extensive text editing language and editor modelled after DEC's TECO.

ZEDIT - \$50, A mini text editor. Character/line oriented. Works well with hardcopy terminals and is easy to use. Includes macro command capability.

TOP I - \$80, A Text Output Processor for formatting manuals, documents, etc. Interprets commands which are entered into the text by an editor. Commands include justify, page number, heading, subheading, centering, and more.

TOP II - \$100, A superset of TOP I. Adds: embedded control characters in the file, page at a time printing, selected portion printing, include/merge files, form feed/CRLF option for paging, instant start up, and final page ejection.

ZDDT - \$40, This is the disk version of our famous Zapple monitor. It will also load hex and relocatable files.

ZAPPLE SOURCE - \$80, This is the source to the SMB ROM version of our famous Zapple monitor. It can be used to create your own custom version or as an example of the features of our assemblers. Must be assembled using one of our assemblers.

MODEM - A communication program for file transfer between systems or using a system as a terminal. Based on the user group version but modified to work with our SMB board or TRS-80 Models I or II. You must specify which version you want.

MODEM SOURCE - \$40, For making your own custom version. Requires one of our Macro Assemblers.

DISASSEMBLER - \$80, Does bulk disassembly of object files creating source files which can be assembled by one of our assemblers.

HARDWARE

S-100 - **SMB II Bare Board** \$50, "System Monitor Board" for S-100 systems. 2 serial ports, 2 parallel ports, cassette interface, 4K memory (ROM, 2708 EPROM, 2114 RAM), and power on jump. When used with Zapple ROM below, it makes putting a S-100 system together a snap.

Zapple ROM \$35, Properly initializes SMB I/II hardware, provides a powerful debug monitor.

IBM PC - **Big Blue Z80 board** \$595, Add Z80 capability to your IBM Personal Computer. Runs CP/M programs but does not require CP/M or TPM. Complete with Z80 CPU, 64K add on memory, serial port, parallel port, time and date clock with battery backup, hard disk interface, and software to attach to PC DOS and transfer programs. Mfr'd by QCS.

50% Discount on all CDL software ordered at the same time as a Big Blue (and for the Big Blue).

APPLE II - **Chairman Z80** \$345, Add Z80 capability to your Apple II/II Plus computer. Runs CP/M programs with our more powerful TPM. Includes 64K memory add on (unlike the competition this is also useable by the 6502/DOS as well as the Z80). TPM, QAL assembler, QED Screen Editor, and Business Basic. Mfr'd by AMT Research.

Apple Special \$175, Buy the Apple Z80 Developer at the same time as the "Chairman" and pay only \$175 instead of \$325.

APPLE Z80 DEVELOPER

Includes: 6502X (\$150), MACRO II (\$100), MACRO III (\$150), QAL (\$200), QED (\$150), LINKER (\$80), DEBUG I (\$80), DEBUG II (\$100), ZDDT (\$40) and BUSINESS BASIC (\$200)

VALUE: \$1250

NOW \$325

\$175 when purchased with AMT "Chairman" Board

ORDERING INFORMATION:

VISA/MasterCard/C.O.D.

Call or Write With Ordering Information...



OEMS:

Many CDL products are available for licensing to OEM's. Write to Carl Galletti with your requirements.

Dealer Inquiries Invited.

For Phone Orders ONLY Call Toll Free...

1-(800) 458-3491

(Except Pa.)

Ask For Extension #15

For information and Tech Queries call
(609) 599-2146

Computer Design Labs

342 Columbus Avenue/Trenton, NJ 08629

CIRCLE 84 ON READER SERVICE CARD



Local Area Networks continued . . .

The logical communication topology is a bus, but the physical topology can be a bus or a non-rooted tree, which means there need not be a central connection of any sort.

The Ethernet Data Link Layer has fully distributed control of the bus by using the CSMA/CD access method. Detection of a collision causes a node to send a jamming signal to notify all nodes that a collision has occurred. The Ethernet packets are variable length with the following format:

Field Description	Size
Destination address	6 bytes
Source address	6 bytes
Type	2 bytes
Data	46 bytes to 1500 bytes
Frame check sequence	4 bytes
Total	64 bytes to 1518 bytes

The Ethernet uses self-clocking Manchester bit-encoding on the bus. A special prefix is sent at the beginning of each packet to synchronize the clocks at each node. Synchronization should occur before the destination address field reaches a node.

The most significant bit of the destination address field is the multicast bit. A zero value indicates that the packet is destined for a single node, while a one indicates that the packet may be destined for multiple nodes. The source and destination address fields allow for significantly more node addresses than the maximum number of nodes specified in the standard. This allows for expansion and an easy interface between Ethernet LANs via gateway nodes. Allocation of addresses is even being handled by Xerox to prevent duplication of addresses when using equipment from different vendors. The large address fields should provide for all cases.

The type and data field are available for use by the other levels in the ISO model and their format is not specified by the Ethernet standard. The fields may contain any data.

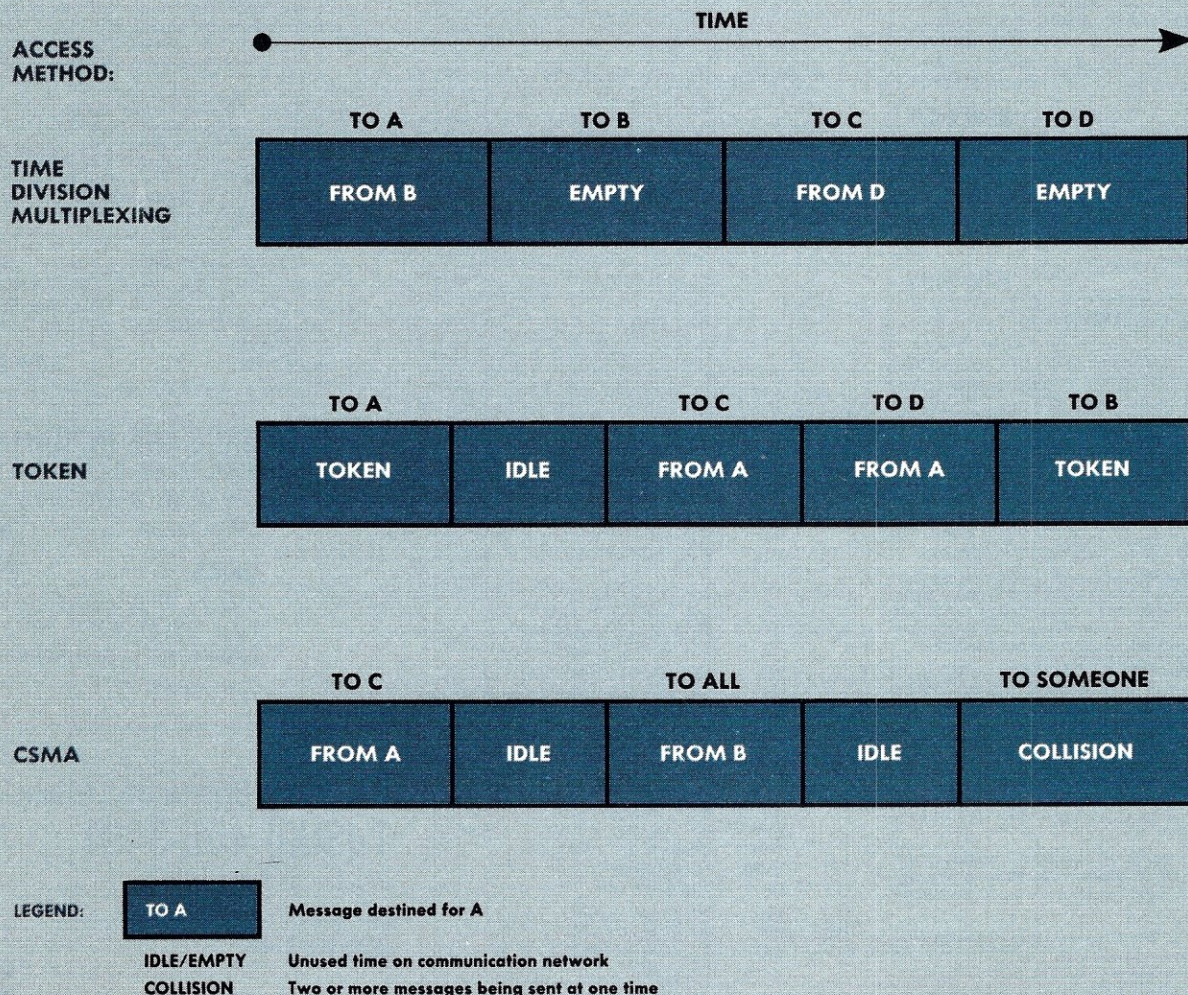
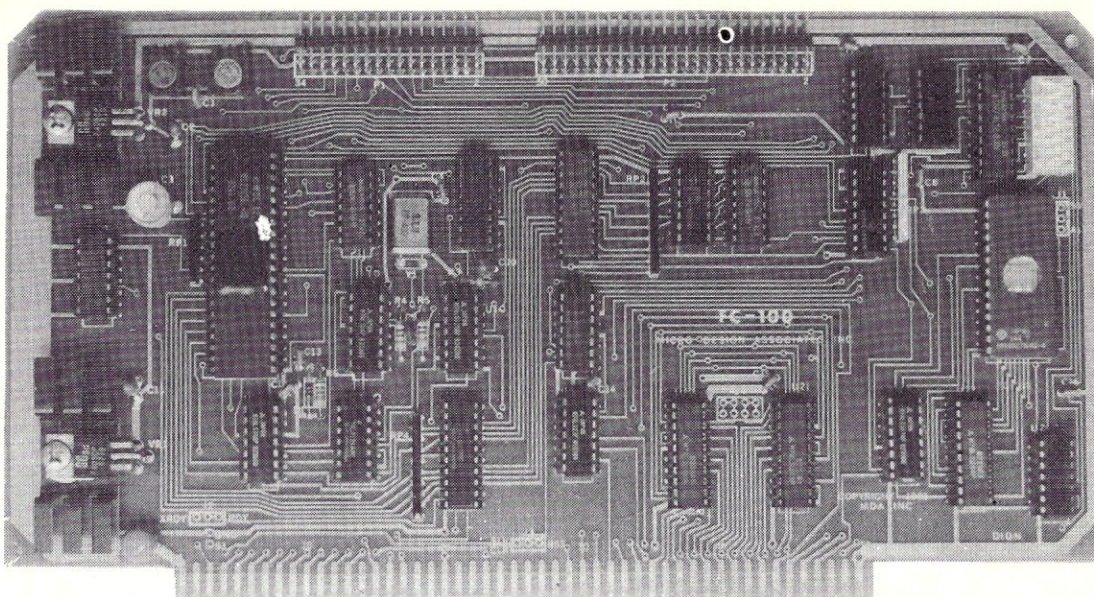


Figure 9. Three access methods.

THE ULTIMATE DISK CONTROLLER

STATE
OF
THE
ART



ALL
SIGNALS
IEEE
696
(S-100)

\$299 **Assembled and Tested**

- Runs 5¼" and 8" drives simultaneously
- Double Side, Double Density (1.4 MB 8")
- On board extended address bus driver (16 Meg)
- On board shadowable ROM (up to 8K)

This controller was designed using the very latest in state-of-the-art technology. The board is made of highest quality epoxy-fiberglass and all components used are available "off the shelf".

- 8 bit or 16 bit data bus
- Low power consumption
- Compatible with all 1771, 179X & 279X software
- I/O mapped (does not take up any memory space)
- Very fast - runs at maximum transfer rate (.5 Meg B)
- Comes with free bios & instructions for your CP/M
- Reads & writes formats of the following systems: IBM 3740, System 34, IBM PC, Cromemco, Televideo, Morrow, Osborne, Kaypro, Lobo, Xerox, TRS 80 models 1, 2, 3, 4, 12, 16 and most other soft sector systems
- Comes with format program & other utilities including Bios for CP/M 2.2
CP/M 2.2 w/Bios - \$100.00
CP/M 3.0 w/Bios - \$250.00



TO ORDER, PHONE:

MICRO DESIGN ASSOCIATES, INC.

25 S. 8th St. (314) 874-2777

Columbia, MO 65201

CIRCLE 85 ON READER SERVICE CARD

1 YEAR WARRANTY!

After warranty service will never cost more than the price of a new board. Replacements shipped within 24 hours.

MANUAL — \$15.00 — Deductible From Purchase of Board

Local Area Networks continued . . .

The reason for the minimum data field size is to keep a minimum packet length. This is required because transmission mode is being used. It takes some small amount of time for a signal to propagate from one end of the coaxial cable to the other and this time is significantly longer than the time for one bit of information to be sent on the Ethernet. This means that a node will be sending a later part of the packet when the first bit of the packet reaches the end of the cable.

This phenomenon becomes important when considering the CSMA/CD access method. If two nodes at opposite ends of the bus send a packet at about the same time, causing a collision, then they should be able to detect the collision and send the jamming signal. They can only do this

consistently if both nodes are transmitting when the first bits from the other packet reach them, hence the minimum packet size. The maximum packet size is a matter of overall system efficiency. Longer packets are more susceptible to errors caused by noise; the longer retransmission time reduces overall system throughput. The maximum data field size is larger than 1024, which is a convenient size for a block of computer information, thereby allowing additional information describing the contents of the data field.

The frame check sequence is a 32-bit cyclic redundancy check (CRC) value computed from all the other fields except the frame check sequence itself. It is used to detect errors, other than collision, during transmission.

The technology for the cables and connectors is stan-

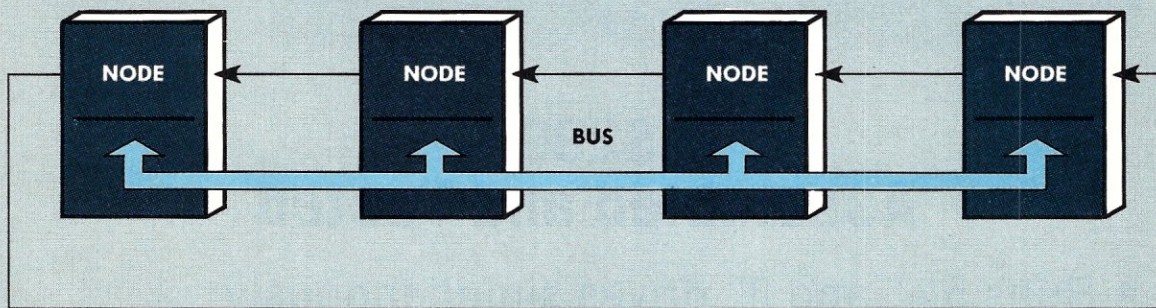


Figure 10. Logical token path (ring).

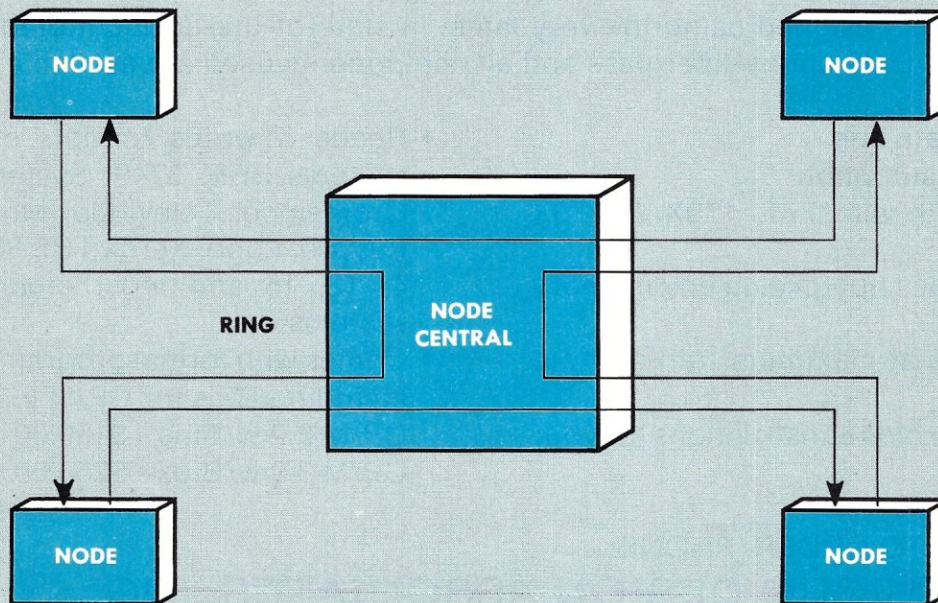


Figure 11. Proposed IBM LAN.

DID YOU EVER NOTICE. . . THAT AFTER A WHILE ALL S-100 BOARDS LOOK ABOUT THE SAME?



NOT SO WITH TARBELL'S NEW DUPLEX 816™ THE LATEST ADDITION TO OUR FAMILY OF PRODUCTS

DUPLEX 816™ 8/16 BIT CPU

A multi-processor controller board from Tarbell centered around the Z-80H®-8-BIT, and 80186-16 BIT processors, runs at 8MHz to provide you with maximum speed. Provisions have been made to support the 8087 math processor for truly remarkable performance. You may put up to 4K of prom on the board, handle multi-user systems, address up to 16 megabytes of main memory, interface two serial I/O ports and one parallel port right on the board, and control floppy disks directly from the Duplex 816™. Clock functions are included for MPM-86® operations. This is truly an exceptional CPU board.

FLOPPY DISK INTERFACE

Tarbell's disk controller board features: double density/single density (software selectable), CP/M® and MP/M® support, with true direct memory access for multi-user and multi-tasking systems. Up to 4 each 8-inch drives can be selected, single or double sided. Connects directly to any Shugart-like drive, modifies for PerSci. We continue to manufacture our single density floppy interface, ideal for use with a wide selection of drives for lower cost considerations.

Z-80B® CPU BOARD

Here is a Z-80B® based board that runs at 6 MHz, complete with memory management that allows dynamic mapping of 1 megabyte of physical memory in 4K blocks. Designed to run multi-user, multi-tasking operations and features programmable priority vectored interrupt hardware, allowing the programmer to selectively disable any combination of six interrupt lines. Provides 2 on-board RS232 I/O ports. This is the heart of any single-user/multi-user system with expansion in mind.

4S/2P INPUT/OUTPUT BOARD

This S-100 four-serial, two-parallel I/O board provides 4 RS-232 I/O ports, full handshaking, four 8251's and eight consecutive 8080 ports. Another feature: four separate dip-switch controlled baud-rate generators. The 2 parallel 8-bit I/O ports feature separate handshaking, use of four consecutive 8080 ports, and four 8-bit latches. The board was designed to provide maximum I/O expansion for multi-user systems.

TARBELL ELECTRONICS

950 DOVLEN PLACE, SUITE B
CARSON, CALIFORNIA 90746

(213) 538-4251
(213) 538-2254

Contact your Tarbell dealer for details

All Tarbell boards include a full six-month warranty

See us at  **COMDEX/Fall '83**

MPM-86, CP/M and MP/M are registered trademarks of Digital Research
Z-80 is a registered trademark of ZILOG

CIRCLE 223 ON READER SERVICE CARD

Local Area Networks continued . . .

dard off-the-shelf parts, and the electrical interface is compatible with standard 10,000 series ECL logic. In fact, this was used for initial implementations; current system implementations, however, are being designed around VLSI chips for the Data Link controllers and the physical drivers and receivers. Xerox is working on a single-chip implementation, but it is not alone.

Intel has an 82586 Ethernet controller chip and 82501 interface chip combination. Seeq 8001, the Mostek MK7990 Local Area Network Controller for Ethernet (LANCE), the Rockwell International R68802, and the AMD AM87991 controller/AM7990 interface chips are just a few other implementations currently available. These chips should reduce the per-node cost for an Ethernet interface from over \$1000 for non-VLSI implementations to under \$400 per node. The cost will be even lower as the prices of these chips fall.

Xerox sells a file server, a print server, and a communications server along with the Star. The Star is a professional workstation that combines a user interface with a computational server. A number of firms sell similar

equipment, including 3COM, which has an interface for the IBM PC along with software for such facilities as electronic mail.

The Omninet is a lower-cost, lower-speed LAN implementation from Corvus. It is also a bus-oriented implementation, though it uses the CSMA/CA access method instead of the Ethernet CSMA/CD access method. This is said to reduce the network interface complexity. The serial bus is implemented using a single twisted-pair wire. The bus interface uses standard EIA RS-422 drivers and receivers along with a Motorola M6801 single chip microcomputer and two custom VLSI chips. This interface is called a transporter. The combination is responsible for the Physical, Data Link, Network, and Transport Layers.

Omninet operates at a Mbps transfer rate with up to 64 nodes, which must be significantly closer than in the maximum Ethernet implementation. Corvus supplies transporters for popular personal computers such as the Apple II, the IBM PC, and others. They also sell a hard disk file and print server with the associated software for the nodes. This software handles the other layers of the ISO model.

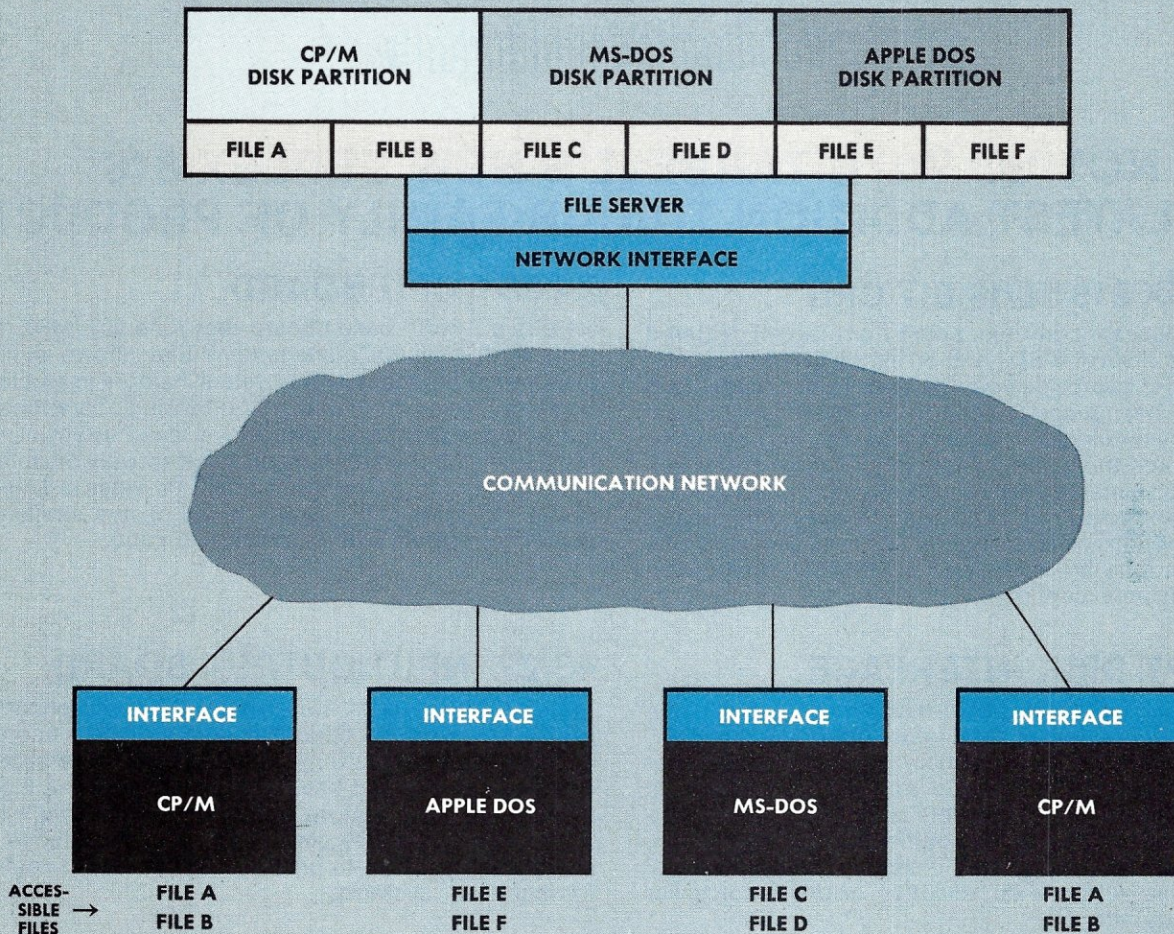


Figure 12. Partitioned file server.

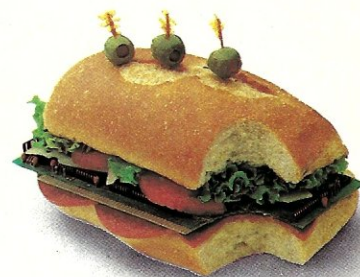
Teletек's New Combo Could Make You A Hero!

The SBC-II could be just the right ingredient for your latest concoction. The newest member of Teletек's family of multi-user, multi-processing S-100 products, the SBC-II essentially combines, or "sandwiches" two Teletек SBC-I's into one board. The SBC-II provides the capability to support two users from one standard size IEEE-696/S-100 slave board.

The SBC-II maintains full performance for each user with an independent CPU (Z80A or Z80B), 64K RAM, Serial I/O, and FIFO communications port to the system master. The system integrator benefits by getting complete support for two users for the price of one board.

TurboDOS and MDZ operating systems will support combinations of SBC-I's and SBC-II's offering system design efficiency and flexibility never before possible.

If you're hungry for value and efficiency, order an SBC-II from Teletек. You'll love every byte.



TELETEK

4600 Pell Drive
Sacramento, CA 95838
(916) 920-4600
Telex 4991834 TELETEK
Dealer inquiries invited.

© Teletек 1983

CIRCLE 174 ON READER SERVICE CARD

Local Area Networks continued . . .

The file server is a partitioned system, where a partition can be allocated to a single operating system such as Apple DOS, MS-DOS, or CP/M. It essentially allows the hard disk to be shared by a number of users, but its shared data base facility is limited.

The ARCnet network was originated by Datapoint and is currently supported by Tandy/Radio Shack. It uses a modified token-passing access method with broadcast capability on a bus operating at 2.5 Mbps with a maximum of 255 nodes. The physical connection is typically a star or a tree. The modification to the token-passing access method is that token passes are acknowledged immediately.

The original implementation was done with coaxial cable and discrete logic. This has been expanded to allow for different connection media, including fiber optics and VLSI interface implementations. Standard Microsystems Corporation currently supplies the COM 9026 Local Area Network Controller (LANC) and COM 9032 interface chips for the ARCnet. It interfaces to the host processor through an external 1K or 2K dual-ported RAM. The system supports a short packet up to 256 bytes and a long

packet up to 512 bytes. The first 2 bytes are the source and destination addresses, followed by the size of the packet and the data. A 2-byte CRC is used for error detection.

CP/NET is a software product from Digital Research Incorporated (DRI), which is adaptable to many LAN implementations. CP/NET (Figure 15) consists of two parts: a Network Disk Operating System (NDOS) and a Network Input/Output System (NIOS). The first is supplied by DRI and the second is supplied by the LAN implementor, although DRI does supply numerous examples. The NDOS corresponds to the Transport, Session, and Presentation layers of the ISO model, while the NIOS encompasses the Physical, Data Link, and Network layers. The current implementation also includes some Application Layer software, including a rudimentary electronic mail facility.

The CP/NET system is configured with a host that usually runs MP/M, a multitasking version of CP/M also from DRI. The host has a special set of programs that are logically connected in a star configuration with one to 16 nodes running CP/M. These nodes run standard CP/M

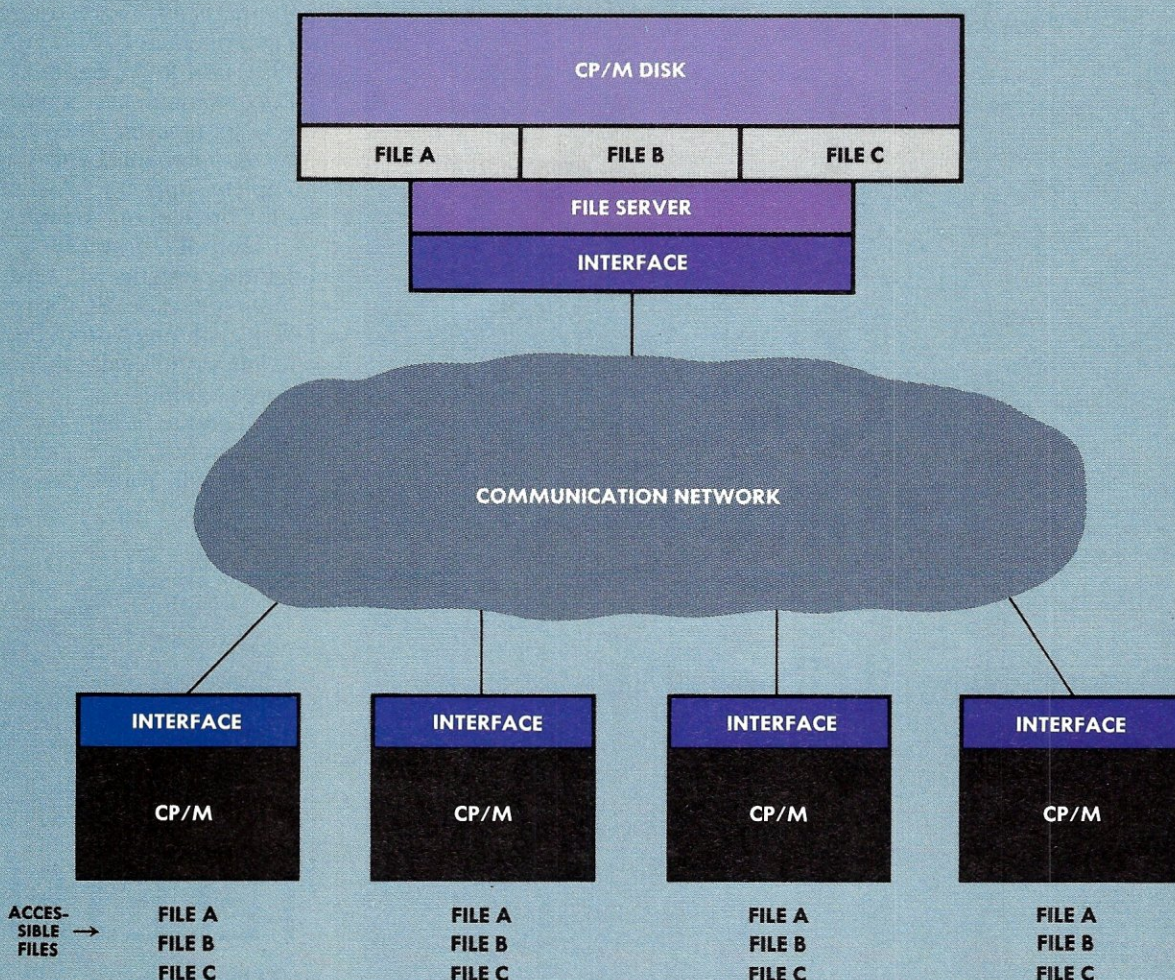


Figure 13. Shared file server.

SANYO DESK-TOP COMPUTERS

"It's a great feeling"

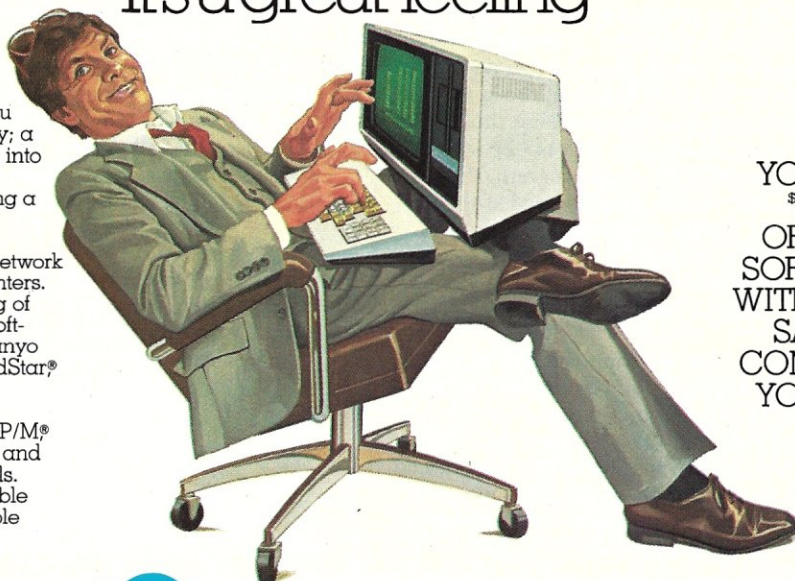
Sanyo computers give you out-of-the-carton reliability; a dependability that is built into every Sanyo product.

It's a great feeling buying a world famous name.

It's a great feeling to be backed by a nationwide network of dealers and service centers.

And the greatest feeling of all is the \$2,000 of FREE software included with all Sanyo business computers: WordStar®, CalcStar®, MailMerge®, SpellStar®, and InfoStar®... along with standard CP/M®, Sanyo Basic® diagnostics and over 20 programmer's tools.

Plus you get unmatched pricing and the unbeatable Sanyo guarantee.



YOU GET
\$2,000
OF FREE
SOFTWARE
WITH EVERY
SANYO
COMPUTER
YOU BUY.



SANYO

DESK-TOP BUSINESS COMPUTERS BY
SANYO BUSINESS SYSTEMS CORP.

CIRCLE 20 ON READER SERVICE CARD

CP/M REVEALED

For beginners. For experienced users. For anyone using CP/M.

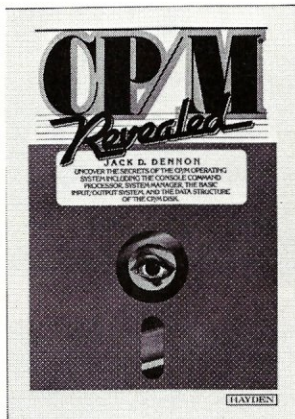
Getting Started with CP/M®

(Patten and Calandrino) A complete beginner's guide. Explains how CP/M operates and describes the structure and functions of its commands. Focuses on subjects most useful to beginners—handling and caring for diskettes, storing and transferring information, creating and naming files, responding to error messages; also details command structures and functions. #5208, \$12.95

CP/M® Revealed

(Dennon) A full working "map" to CP/M—the console monitor, system manager, and input/output driver package. Coverage includes booting up, logging in, changing memory size, mapping disk space, calling up programs, interfacing, I/O devices, and more. Clarifies many instructions in the Digital Research CP/M manual, and fills information gaps the manual leaves. #5204, \$15.95

CP/M is a registered trademark of Digital Research, Inc.



Hayden

Order by Phone 1-800-631-0856

operator MSN3

In NJ call (201) 843-0550, Book Sales

Mail to:

Dept. MSN3 • Hayden Book Company, Inc.
10 Mulholland Drive
Hasbrouck Heights, NJ 07604

Please send me:

- ☐ Getting Started with CP/M, #5208
☐ CP/M Revealed, #5204

If I am not completely satisfied, I may return the book(s), undamaged, within 10 days for a complete refund. I am enclosing \$2.00 to cover postage and handling.

- ☐ Enclosed is my check or money order.
☐ Bill my ☐ Visa ☐ MasterCard

Name _____

Address _____

City _____

State/Zip _____

Visa/MasterCard # _____

Exp. _____

Signature _____

Residents of NJ and CA must add sales tax.
Prices subject to change.

CIRCLE 25 ON READER SERVICE CARD

with additional CP/NET software. Each node has 16 logical disk drives and one logical printer. Operating system commands allow a node to assign these logical devices to local physical devices or physical devices at the host.

Application programs operate by accessing the logical devices and are unaware that a device may not be resident. This means that the typical CP/M copy program, PIP, can be used to move a file from a disk drive located at the host to a local disk drive by simply assigning the appropriate physical devices to the associated logical devices. The CP/NET system implements a shared file server, so more than one node can be linked simultaneously to the same physical host disk.

The CP/NET system is more sophisticated in that it supports the password protection, and record and file locking functions of MP/M. These functions are very important when using a shared data base at the host. This is something which is not usually possible with a partitioned file server. CP/NET has many other features too numerous to mention here; however, one option which may be of particular interest is a version of CP/NET called CP/

NOS. This version has no local disk drives, but instead uses only those at the host.

CP/NET is of particular interest because the NIOS can be customized to support just about any Physical and Data Link implementation including Ethernet, Omnet, and ARCnet. In fact, many implementations already exist. CP/NET is just one example of how the various layers in the ISO model can be partitioned in an implementation.

Summary

Local area networks are becoming more prevalent in today's computer industry. The array of existing and future products in this area continues to grow. Hopefully this article has been able to shed some light on the subject. **□**

Bill Wong is currently doing program development for Rising Star. He received his M.S. in Computer Sciences from Rutgers and his B.E.E. from Georgia Tech. Bill is interested in microcomputer systems, parallel processing and artificial intelligence.

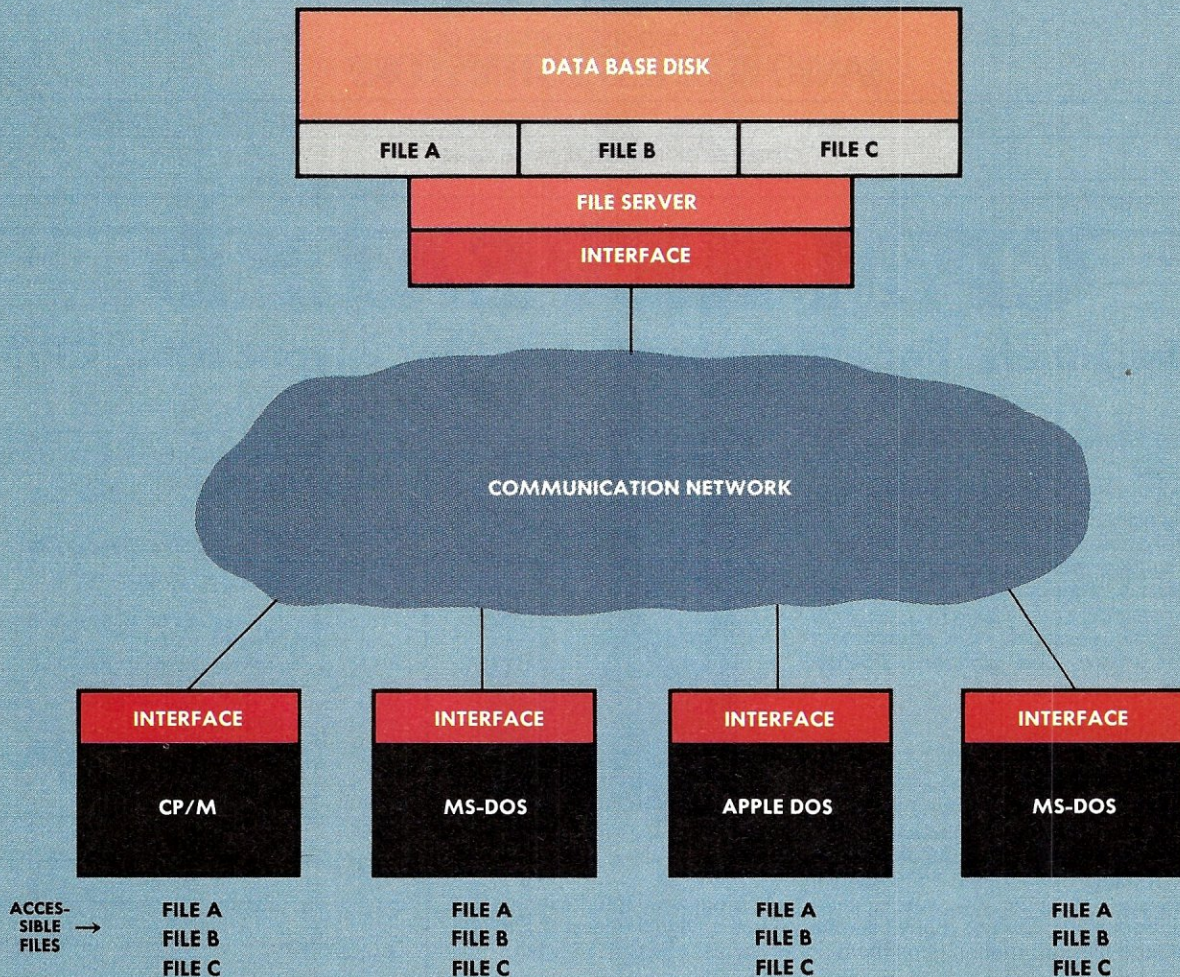


Figure 14. Data base file server.

Linked at Last!

MSPRO™ unites MS-DOS® and CompuPro®.

Now, lovers of CompuPro® hardware can be users of most IBM software. The MSPRO™ subsystem turns a clash of titans into a league of nations, by making the world of MS-DOS® based software available to CompuPro® users for the first time.

MSPRO™ supports your existing 8-inch drives and up to four 5-1/4 inch drives for transferring files. Includes one 5-1/4 inch disk drive in enclosure with power supply (\$325 single sided 48 tpi, \$395 double sided 48 tpi), disk controller board (\$350), MSPRO™ operating system diskette (\$395, with cables and manual). Dealer inquiries invited. Send \$4.00 for complete manual.

MS-DOS is a registered trademark of Digital Research Inc.
CompuPro is a registered trademark of Godbout Electronics
MSPRO is a trademark of Computer House Inc.

See how the other half computes.

Order MSPRO™ today, from **Computer House** (a Full Service CompuPro System Center), 722 B St., San Rafael, CA 95901. Call (415) 453-0865 for further details.



CIRCLE 62 ON READER SERVICE CARD

Q/C Version 3.1

Vacation? What's a vacation?

Jim Colvin just won't quit! He keeps improving his compiler for the popular C programming language. After releasing Version 3 in May, we told him to take a vacation. He did, for a whole week! But then he went to work and added **typedef**, **sizeof**, type casts, and function typing in Q/C Version 3.1. He also wrote six new i/o functions, including **setbuf()** and **setsize()** to support large file buffers.

For only \$95, you get a ready-to-use C compiler for CP/M, as well as the complete source code for the entire package. This fully-supported compiler supports a large subset of C, and is upward compatible with the UNIX Version 7 compiler from Bell Labs. The Q/C library includes over 60 input/output and other support functions. Q/C features include:

- Complete source code for compiler and i/o library.
- No license fees on object code.
- 8080 and Z80 (with Zilog mnemonics) versions available.
- Produces ROMable code.
- Excellent support for assembly language.

In the 136-page *Q/C User's Manual* Jim tells you how to use the compiler and clearly describes each library function. There's even a chapter about the "internals" of the compiler. Jim puts his *home phone number* in the manual so you can get help evenings and weekends from the author, in addition to support during the day from The Code Works. (You can buy the manual for \$20, which applies toward purchase of Q/C.)

Write or call for details of Q/C Version 3.1. Disk formats include 8-in. single density, KayPro, Osborne DD, Morrow, Televideo 802, and Apple CP/M. VISA and MasterCard welcome.

THE CODE WORKS

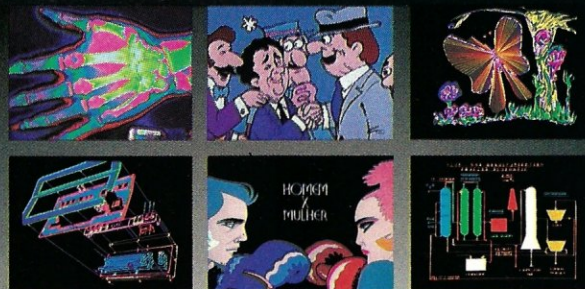
2566 Hollister
Suite 224
Santa Barbara, CA 93111
(805) 683-1585

Q/C, CP/M, Z80, and UNIX are trademarks of Quality Computer Systems, Digital Research, Zilog, Inc., and Bell Laboratories respectively.

CIRCLE 64 ON READER SERVICE CARD

The Image Solution

*The CAT 1600 Series
lets you take full
advantage of your color
graphics potential.*



Plug this powerful color video graphic system into your IEEE-696 bus and watch your computer open its eyes. Exercise your creativity developing new ways to study your world and discovering the flexibility of video imaging. Our real time frame grabber gives you instant availability of the image to be processed. The CAT 1600 is the creative link between machine, man and the world.

Resolution is the name of the game, and we've got it. Physically you're looking at 512x512 pixels up to 24 bits deep. And that's real color. Now, center on a pixel, any pixel, and roam the screen through an image space as large as 1Kx2K. Zoom in and explore a close-up of 32:1, not in the usual quantum leaps of integer zooms, but in smooth logarithmic steps of 1.1% A smooth zoom... that's human engineering.

At the heart of the matter is a dedicated 8086 image processor. It blazes a 16 bit wide path through the various memories, lookup tables and image parameters as it executes high level commands from your host processor. Up to 48K of static

RAM makes the image processor useful for downloading custom programs from the host.

When it came to adequate memory, we didn't forget. 768KB of dynamic memory gives you plenty of image. Our PROMs have a library of 64K organized into over 130 sophisticated graphics commands such as continuous live digitization, character and shape generation, global image manipulation and animation effects, to relieve the host computer from low level primitives.

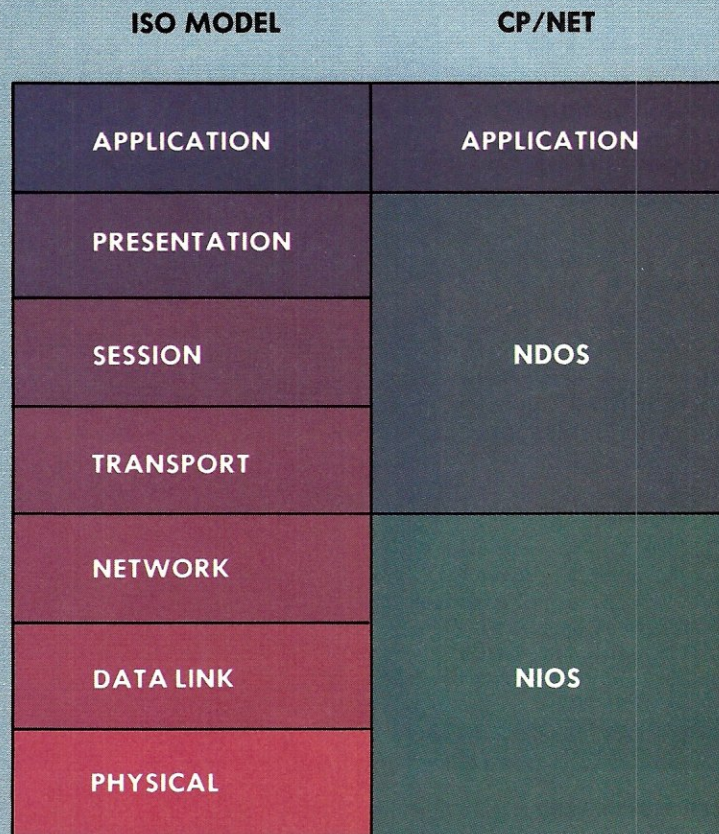
At your disposal is a palette of 16.7 million colors and 256 shades of gray. Quantized lines or free-hand sketching completes the picture. Use a variety of pen widths, brush strokes, even airbrush! Now imagine what you can do with a superb quality image captured in real time from a color video camera. Contact us for an eye opening demonstration: 935 Industrial Avenue, Palo Alto, CA 94303. 415/856-2500

DIGITAL GRAPHIC SYSTEMS, INC.

What you see is what you get.

CIRCLE 33 ON READER SERVICE CARD

Local Area Networks continued . . .



RELATIONSHIP BETWEEN ISO NETWORK MODEL AND CP/NET

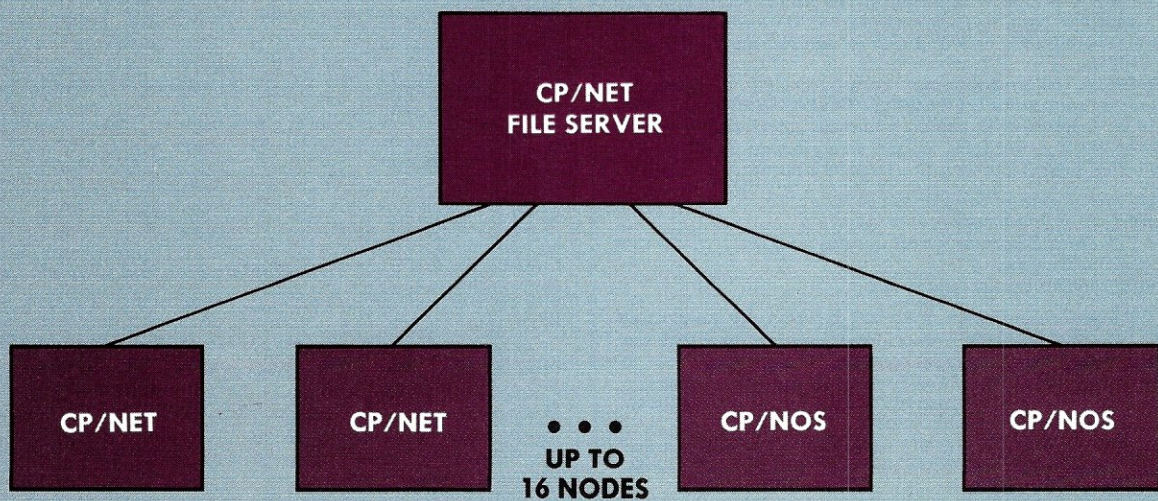


Figure 15. Logical CP/NET configuration.

MIKROKOLOR S-100 COLOR GRAPHICS

HIGH RESOLUTION COLOR GRAPHICS BOARD, as featured in 80 Micro May & June 1983.

High resolution color graphics for graphs, charts, animation, games, business applications, teaching, scientific display. Allows full color text and graphics on Color Monitor or on Color TV with modulator use. 256 x 192 Color Graphics - 15 colors plus transparent.

3 dimensional Sprite planes - Simultaneous display of planes.

4 Modes of operation available:

1. - TEXT: 24 lines - 40 characters, 6 x 8 matrix, 256 user definable characters.
2. - MULTICOLOR: 64 x 48 Color Graphics
3. - GRAPHICS 1: 256 x 192 Color graphics, 24 lines - 32 characters, 8 x 8 matrix, 2 colors per character.
4. - GRAPHICS 2: Same as Graphics 1 except 16 colors per character.

SPRITES: Active in all but text mode, 32 prioritized 3-D planes 15 colors plus transparent, easily provides animated graphics with simultaneous display of all sprites. Composite video output (NTSC) Comes with sample programs and instructions. Uses Texas Instruments TMS9918A Video Display Processor. On board RAM uses no system memory space. No hardware modifications necessary. Plugs into motherboard and conforms to IEEE-696 conventions. Switch selectable address decoding of 256 ports.

User manual only - \$5.00. Money order, COD, checks or credit card. Personal checks must clear. COD add \$2.00. Visa, Mastercard add 4%. Calif. residents add 6% sales tax. DEALER INQUIRIES INVITED.

\$175.00 Assembled and tested.

\$150.00 Kit form, w/instructions.

**ANDREASEN'S ELECTRONICS
RESEARCH & DEVELOPMENT, Inc.**

Technical Assistance: Box 5686,
Vandenberg, Ca. 93437

To Order: 1548 Monterey St., San Luis
Obispo, Ca. 93401 ph (805) 541-6398

CIRCLE 5 ON READER SERVICE CARD

GREAT FEELING #CRX 1100

High performance CRT with host of terminal functions. Permanent memory for set-up. Monitor mode allows debugging of host computer software.



Parallel and RS-232C interface. Partial scroll and block mode. 8 user programmable keys.

\$695.

SANYO DESK-TOP COMPUTERS

"It's a great feeling"



DESK-TOP BUSINESS COMPUTERS BY

SANYO BUSINESS SYSTEMS CORP.

51 Joseph St., Moonachie, N.J. 07074 (201) 440-9300 (800) 526-7043

CIRCLE 21 ON READER SERVICE CARD

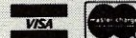
Train Your Computer to DO MORE with 60 UNIX-Style Tools from Carousel.



YOU TRAIN A COMPUTER by writing scripts for it to follow at your command. These scripts tell the computer the things you want it to do to complete a task. Once trained, your computer can repeat the script whenever you want. Carousel's manual and tutorials teach you how to write scripts.

CAROUSEL's SOFTWARE TOOLS add the power of 60 UNIX-style commands to your CP/M and MSDOS operating systems. The Tools work with your word-processor, data-base, spread-sheet and other programs to improve their utility. The Tools are simple to use, easy to remember and useful for training computers.

ORDER TODAY: Carousel's Start-a-ToolKit is \$99, add-ons are from \$35. Buy the full Use-a-ToolKit for \$249; only \$100 more gets the source for most of the Tools.



CALL OR WRITE:



CAROUSEL MICROTOOLS, INC.

609 Kearney Street, El Cerrito, CA 94530 (415) 528-1300

UNIX is a trademark of Bell Laboratories; CP/M is a trademark of Digital Research. MSDOS is a trademark of MicroSoft. Carousel Start-a-ToolKit and Carousel Use-a-ToolKit are trademarks of Carousel MicroTools, Inc.

CIRCLE 6 ON READER SERVICE CARD

Announcing A Major New Innovation From The Publishers Of 

Now, Get Up To 72 Programs For As Little As \$2.00 Each.

Introducing PC DISK MAGAZINE. The Only Magazine On Disk That Gives You A Library Of Software Programs For Your IBM Personal Computer ... At A Fraction Of The Price!

Imagine building a library of software programs with amazing ease...adding utilities, subroutines, games and data files to your system...for as little as \$2 per program! Introducing PC DISK MAGAZINE—a totally new concept for your microcomputer that gives you all this and more! You get thoroughly tested, ready-to-run programs on a floppy disk—complete with a comprehensive, illustrated User Manual—for the ultimate in ease, efficiency and economy. With your subscription to PC DISK MAGAZINE you'll receive a floppy disk containing up to 12 varied ready-to-use programs and files. Developed by experts and tested by the editors, you'll be able to expand the use of your IBM personal computer.

Business and Finance Aids: Create advanced pie, bar and line chart graphics. Compute loan payment tables. Calculate the Present Value and Internal Rate of Return for your investments. VisiCalc® templates for

Real Estate, Lease/Purchase and Tax Shelter analysis.

Programming Tools: Create cross-reference listings for your BASIC programs. Convert MBASIC™ program files to CBASIC™ format or reverse. Use your text editor on your BASIC programs. Convert data between BASIC and VISICALC® or Supercalc® formats.

Home/Personal Applications: Whether you need your own income tax return helper...proven ways to maintain a mailing list...a personal cash flow analyzer...a speed reading trainer...or SAT test preparation aids, you'll get it from PC DISK MAGAZINE.

Utilities and Diagnostics: Print graphics, screen images on your printer...backup, copy, delete, un-delete or type files with simple menu commands. Use your computer to simulate a conversational terminal with function key control of disk or printer logging...and more.

Data Files: Tax tables, population statistics, dictionaries and economic times series.

Games: Adventures! Strategies! Test your skills, intelligence and your luck!



Everything Is Ready For You

PC DISK MAGAZINE has everything you need. The accompanying 60-page User Manual is written clearly, concisely, in easy-to-understand terms. You'll be able to try the programs immediately...there's no need to type listings into your computer. Just insert the disk and go! That simply, all the latest software developments are at your fingertips!

A LIBRARY OF SOFTWARE PROGRAMS FOR THE IBM PERSONAL COMPUTER

PC DISK MAGAZINE

BUSINESS & FINANCE

LOAN ANALYZER
AUTOMATIC BAR CHARTER
WORDSTAR CONFIGURATOR

PROGRAMMING TOOLS

BASIC PROGRAM EDITOR
PERPETUAL CALENDAR

HOME/PERSONAL

PERSONAL CASH FLOW MANAGER
(PART I OF III)

UTILITIES & DIAGNOSTICS

DISK MAP
IBM MATRIX PRINTER
CONTROL

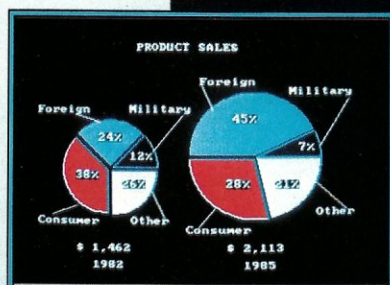
DATA FILES

DEMOGRAPHIC DATA FILE

GAMES

HIDE AND SINK
PYRAMID WATCH

COPYRIGHT © 1983 BY ZIFF-DAVIS PUBLISHING COMPANY. ALL RIGHTS RESERVED



Date	Amount	Category	YTD Total
2/17	100.00	Salary	100.00
2/18	100.00	Salary	200.00
2/19	100.00	Salary	300.00
2/20	100.00	Salary	400.00
2/21	100.00	Salary	500.00
2/22	100.00	Salary	600.00
2/23	100.00	Salary	700.00
2/24	100.00	Salary	800.00
2/25	100.00	Salary	900.00
2/26	100.00	Salary	1000.00
2/27	100.00	Salary	1100.00
2/28	100.00	Salary	1200.00
2/29	100.00	Salary	1300.00
2/30	100.00	Salary	1400.00
3/1	100.00	Salary	1500.00
3/2	100.00	Salary	1600.00
3/3	100.00	Salary	1700.00
3/4	100.00	Salary	1800.00
3/5	100.00	Salary	1900.00
3/6	100.00	Salary	2000.00
3/7	100.00	Salary	2100.00
3/8	100.00	Salary	2200.00
3/9	100.00	Salary	2300.00
3/10	100.00	Salary	2400.00
3/11	100.00	Salary	2500.00
3/12	100.00	Salary	2600.00
3/13	100.00	Salary	2700.00
3/14	100.00	Salary	2800.00
3/15	100.00	Salary	2900.00
3/16	100.00	Salary	3000.00
3/17	100.00	Salary	3100.00
3/18	100.00	Salary	3200.00
3/19	100.00	Salary	3300.00
3/20	100.00	Salary	3400.00
3/21	100.00	Salary	3500.00
3/22	100.00	Salary	3600.00
3/23	100.00	Salary	3700.00
3/24	100.00	Salary	3800.00
3/25	100.00	Salary	3900.00
3/26	100.00	Salary	4000.00
3/27	100.00	Salary	4100.00
3/28	100.00	Salary	4200.00
3/29	100.00	Salary	4300.00
3/30	100.00	Salary	4400.00
3/31	100.00	Salary	4500.00

UNIVERSAL FILE PRINT UTILITY

File: File: File:

Start: Page Record Column:

Stop: Page Record Column:

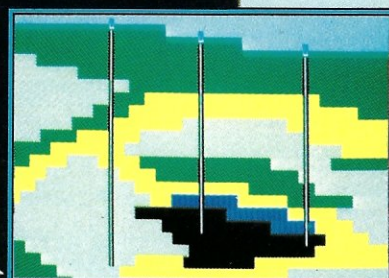
Line Numbers? ☐ Page Numbers? ☐ Print on Header? ☐

Spacing? ☐ Suppress Control? ☐ Truncate? ☐

Upper Case? ☐ Print Control? ☐ Print Header? ☐

Page Numbering:

Page Footing:



PRODUCT SPECIFICATIONS

- Programs will run on IBM personal computers under PC-DOS and MS-DOS versions 1.1 and 2.0 and require a minimum of 64K.
- Most programs will be written to run on both monochrome and color displays; however, some games and utilities may be specifically developed for color display.
- Most programs will be written in advanced Basic; however, some machine language and compiled code may be used.
- Programs and documentation are copyrighted by Ziff-Davis Publishing Company. All rights of reproduction in all forms and media strictly reserved.

PROGRAM SUBMISSIONS

If you wish to submit a program for inclusion in future issues, please write to: PC DISK MAGAZINE, Attn: Editor, One Park Avenue—Dept. 732, New York, N.Y. 10016.

GUARANTEE

- All programs are fully tested and guaranteed to run. Damaged or faulty disks will be replaced at no charge.
- If you wish to cancel a subscription, simply return the most recent disk in its sealed package and you will receive a full refund for this copy and on all unmailed issues.

Save \$60 With This Introductory Savings Offer. Get 6 Big Issues of PC DISK MAGAZINE And Save 34%.

PC DISK
MAGAZINE

P.O. Box 2462, Boulder, CO 80322

8H104

YES, Please accept my subscription to PC DISK MAGAZINE for 6 issues at the Special Introductory Price of just \$119 (less than \$20 per issue, as little as \$2 per program). I save \$60—34% off the full price of \$179.

Check one: ☐ Please bill me. ☐ Payment enclosed.
☐ Please charge to my credit card.
☐ American Express ☐ Visa
☐ MasterCard

Credit Card No. _____ Exp. Date _____

Name _____

Address _____

City _____

State _____ Zip _____

MAIL NO-RISK COUPON TODAY — AND SAVE 34%!

Local Area Networks continued . . .

Table 2. A Few Existing LAN Implementations

Network	Company	Connection Topology	Access Method	Data Rate (bps)	Maximum Nodes	Distance (meters)	Reader Service #
ARC	Datapoint	Coax Bus	Token	2.5 M	255	610	300
		Fiber Bus	Token	2.5 M	255	1600	
Cluster/1	Nestar Systems	Wire Bus	CSMA/CD	250 K	65	300	301
Domain	Apollo Computer	Coax Ring	Token	12 M	-	900	302
Ethernet	Xerox	Coax Bus	CSMA/CD	10 M	1024	2500	303
	3COM						304
	DEC						305
	Intel						306
	Ungerman/Bass						307
HYPERbus	Network Systems	Coax Bus	CSMA/CD	10 M	128	730	308
HYPERchannel		Coax Bus	CSMA/CD	50 M	16	1500	309
LINC	Vector Graphics	Wire Ring	Token	750 K	16	3200	310
Modway	Gould	Coax Bus	Token	1.544 M	250	4500	311
Omnalink	Northern Telecom	Coax Ring	Token	40 K	20	1500	312
OmniNet	Corvus	Wire Bus	CSMA/CA	1 M	64	1200	313
PLAN 4000	Nestar Systems	Coax Ring	Token	2.5 M	255	6400	314
Primenet	Prime Computers	Coax Ring	Token	10 M	247	3048	315
proNET	Proteon Assoc.	Coax Ring	Token	10 M	255	2400	316
NorthNet	North Star	Wire Bus	CSMA/CA	1 M	64	1200	317
Wangnet	Wang Labs	Coax Tree	Broadband	64 K	-	1000	318
Z-Net	Zilog	Coax Bus	CSMA/CD	800 K	255	2000	319

System Solutions from Total Access

Access S-100 Systems for the best in S-100

Complete, Ready to Run Systems That Feature:

Advanced Digital & Teletek	64k Memory	Hard Disk Options
Integrand Enclosures	2 Serial Ports	Cache Memory Options
2 Mitsubishi DS DD 8" drives	2 Parallel Ports	Free Software
Freedom 100 Terminal	Full DMA Control	CP/M* 2.2
Multi Processor Options	Turbodos Options	1 Year Warranty

ACCESS I - \$2950	ACCESS II - \$2975
10 slot mainframe	7 slot woodside enclosure
ACCESS III - \$2850	ACCESS IV - \$2950
4 slot mainframe	5 slot rack-mount frame
8" slimline drives	

8/16 System

Featuring:

Dual Processors	1 Year Warranty
8" D.S.D.D. Drives	256K Memory
Concurrent CP/M* 86	Choice of Terminal
10M Hard Disk Option	10 Slot S-100 Frame

Only \$3990

*CP/M is a trademark of Digital Research, Inc.

DESIGN MASTER

Complete Graphics CAD System

8/16 Version - \$12,500
8 Bit Version - \$9,995

A-1000 Graphics Controller
Access S-100 System with 10M Hard Disk
Bausch & Lomb DMP 41 Plotter
High Resolution RGB Monitor
Freedom 100 Terminal
AutoCAD

Dasoft and other design packages available

Total Access offers a wide range of S-100 systems and subsystems. Configurations to your special need can be met. OEM & Dealer pricing available. Full line of Peripherals & CP/M* Software available. Call for pricing and information.

415-540-8066
Total Access Systems
2054 University Ave., Suite 200
Berkeley, CA 94704
Telex: 4995100

WES

WORD PROCESSOR & CALC
& EDITOR & MAIL MERGE
& REPORT GENERATOR

- All in one 34K program
- For 8 and 16 bit micros
- Easily customized
- Manual & 25 Practice Jobs

WES

HAS THE FEATURES
YOU WANT. DOES MANY
JOBS. IS EASY TO
LEARN. WORKS FAST
(SUPER FOR MULTI-USERS)

REG \$495 SPECIAL \$295

VISUAL EDITORS

- Complete Macro Language
- Customizable
- Extensible
- Fast
- Compact

Name	Chip	Reg	Special
MATE	80	\$175	\$145
PMATE	86	\$225	\$195
VOLLEY	68K	\$225	\$195



137 Main Street
Westerly, RI 02891
CALL [401] 596-1811

CIRCLE 59 ON READER SERVICE CARD

GREAT FEELING #MBC 550

The MBC 550 Series—16 bit computer offers a personal computer at an affordable price: Initial 160K drive, 128K memory, 8088 CPU, printer port, 10 function keys, Sanyo color graphic Basic.

\$999.

Shown: MBC 550 with 2 drives, monochrome monitor optional. Color monitor optional. Second drive optional.



YOU GET
OVER \$1000
OF FREE
BUSINESS
SOFTWARE
WITH EVERY
SANYO
COMPUTER
YOU BUY.



SANYO DESK-TOP COMPUTERS

"It's a great feeling"



SANYO

DESK-TOP BUSINESS COMPUTERS BY
SANYO BUSINESS SYSTEMS CORP.

51 Joseph Street, Moonachie, N.J. 07074 (201) 440-9300

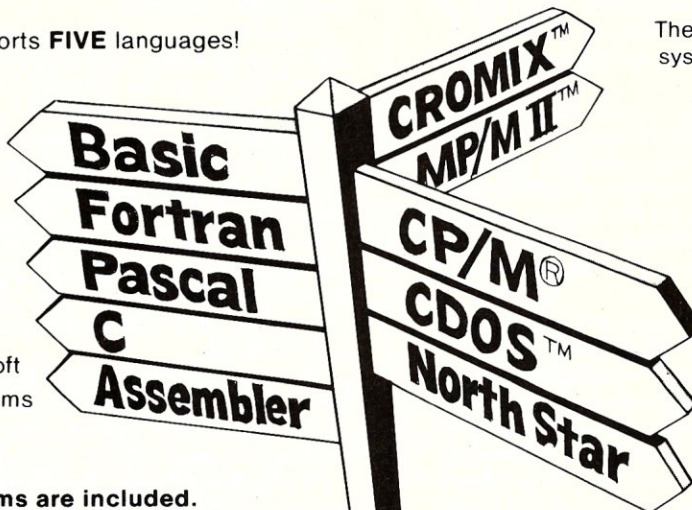
CIRCLE 22 ON READER SERVICE CARD

THE P&T BUS GOES TO THEM ALL!

The P&T-488 interface enables you to use your S-100 computer and any of these operating systems and languages to communicate with 488 equipment.

The P&T-488 supports **FIVE** languages!

- Basic:
 - Microsoft
 - CBasic 2⁺
 - Cromemco
 - North Star
- Pascal:
 - Pascal/MTM
 - Pascal/MT+TM
- Fortran: Microsoft
- C: Quality Systems
- Assembler



Sample Programs are included.

- ★ CP/M and CBasic 2 are registered trademarks, and MP/M II and Pascal/MT+ are trademarks of Digital Research, Inc.
- ★ CDOS and CROMIX are trademarks of Cromemco, Inc.
- ★ Pascal/M is a trademark of Sorcim

The P&T-488 supports **5** operating systems, **2** of which are multiuser!

The P&T-488 includes useful utilities!

- Interactive **bus monitor** aids setting up test equipment.
- **Self test** checks the interface for proper operation

The P&T-488 is **complete!**

Interface, manual, programs on disk, 18" cable and connector mounting hardware are all included for \$450 (domestic, FOB Goleta).

PICKLES & TROUT
BOX 1206 • GOLETA • CA 93116
(805) 685-4641



CIRCLE 70 ON READER SERVICE CARD

The Zenith Low-Profile Z-100 Computer System

by Dave Hardy and Ken Jackson

The Z-100 low-profile desktop computer system from Zenith Data Systems (manufactured by Heath Co.) is another entry into the dual-processor 8085/8088 market. What distinguishes the Z-100 from its competitors is its high quality and its completeness as a whole computing system.

Features

The Z-100 is available in a conventional desktop cabinet with a built-in monochrome monitor and as a low-profile machine without a built-in monitor. Both of these models can also be purchased in kit form and assembled in the usual Heathkit fashion.

The Z-100 cabinet, which contains one or two double-sided 40-track 5 $\frac{1}{4}$ " floppy drives, a power supply, keyboard, plus a motherboard with two serial ports and a Centronics port, has something even more interesting than its 8085/8088 hardware: a five-slot S-100 (IEEE-696) bus.

Also built into the Z-100 is a video board that can display eight colors (or eight levels of gray if you don't have a color monitor) in a 640 by 225 pixel array. The dynamically redefinable character set provides an 80-character by 25-line display. Optionally, the board can also include a second page of video display and a light pen. The video board uses VT-52 control functions.

The basic Z-100 comes with 128K of user-addressable RAM, which can be expanded up to $\frac{3}{4}$ MB.

Hardware

Like all Heath products, the Z-100 is 100% high-quality hardware, well designed and dependable. The cabinet is heavy foam plastic, reinforced by an internal metal chassis. The low-profile unit is particularly rugged and compact.

Inside, all ICs are socketed, and the drives and power supply are fully shielded.

Keyboard. The 95-key keyboard, which includes a separate numeric keypad, has sculpted keycaps and a good "feel" for both touch-typists and hunt-and-peck computer hackers. It is well laid out, and resembles a standard IBM typewriter keyboard in appearance. Besides the numeric keypad, the keyboard has an additional 12 function keys, which may be assigned by the user to do whatever task is desired.

Actually, the keyboard is itself a complete 8-bit computer, with an 8041A processor with 1K of ROM and 8K of RAM, a clock, a counter/timer, and two parallel I/O ports on-board. Whenever a key is pressed, the keyboard generates an interrupt to the motherboard's 8259 interrupt controller. Auto-repeat and audio keyclick can be software selected, and a built-in 17-character FIFO (type-ahead) buffer is also under software control. In all, the keyboard accepts 14 commands to do these things and more, including enabling interrupts to the 8259, changing the scan mode, and turning the keyboard on and off.

Dave Hardy, 736 Notre Dame, Grosse Pointe, MI 48230



Zenith low-profile Z-100, exterior view.

Video. The built-in video board (as mentioned above) can be used as a VT-52 cursor control compatible terminal, or as a high-resolution graphics display of 640 by 225 pixels. Composite monochrome video, composite sync, horizontal sync, vertical sync, and RGB video signals are generated for use with different monitors. We were provided with a Zenith 15" RGB monitor for our tests, and the display was quite good, with excellent linearity and color.

Characters are displayed in an 8 by 9 matrix, and are well defined. If you don't like the characters, you can make your own character set. Character sets for several different languages are available, and can be easily loaded into the character generator.

The video board allows an alternate display format, which could be used to provide an interlaced display of 640 by 525 pixels, but no information is provided on specific programming for that purpose.

The color display is produced from three separate banks of video RAM, one for each main color (red, green and blue). Using this scheme, eight colors are available in much the same way that a color television makes different colors. By turning on combinations of the three main colors, eight colors are produced: black, blue, red, magenta, green, cyan, yellow, and white. The monochrome display can use the color selections to produce eight different levels of intensity.

The optional light pen detects the pulse made by the first pixel it "sees" when pressed against the video screen and generates a pulse of its own to cause the video board to remember the exact address of the pixel detected.

Motherboard; I/O. The 8085 and 8088 processors run at 5MHz. The 8085 uses standard 16-bit addressing, extended to 24 (IEEE-696). The 8088 uses 20-bit addressing, extended to 24 bits. Both processors can use interrupts generated by the 8259. In addition, each processor is also interrupted by NMI* (nonmaskable interrupt from the S-100 bus) and power failure. Both processors can also per-

form DMA to external (S-100 plug-in) devices.

Various configurations of RAM and ROM are available, but the Z-100 can hold up to 196K of RAM, and up to 32K of ROM.

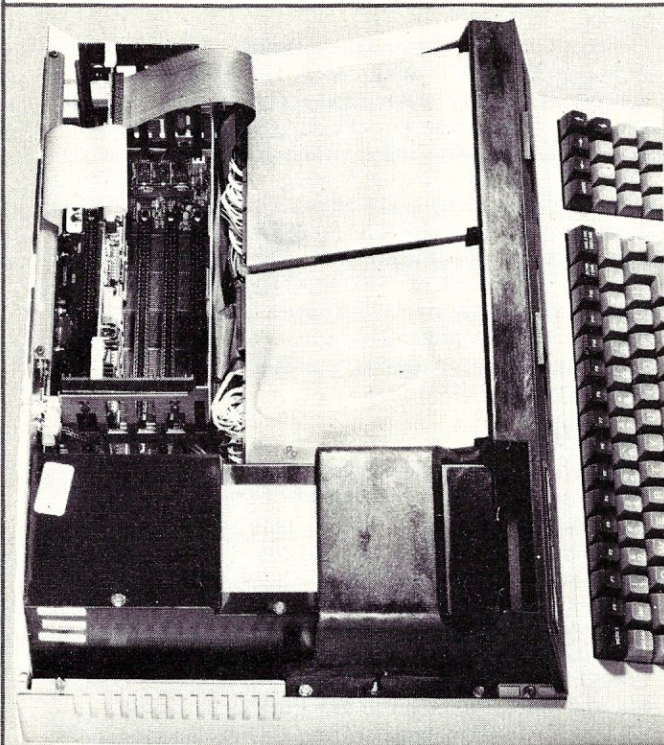
The master 8259 interrupt controller generates eight different interrupts:

- Level 0 — Error (Monitors S-100 bus pin 98)
- 1 — Processor swap
- 2 — 8253 timer output #0 or #2
- 3 — Slave 8259
- 4 — Serial port A
- 5 — Serial port B
- 6 — Keyboard/Display
- 7 — Printer

The most interesting of these interrupts is the Processor Swap interrupt (Level 1), which allows the currently selected processor to be interrupted for a processor "swap," to switch in the *other* processor (8085 or 8088). The Z-100 has a processor "swap" port that allows a program to switch from one processor to another, and cause the newly selected processor to pick up where it left off, or force a restart to occur as the newly selected processor becomes active.

The Z-100 is one of the few machines we've seen that makes use of the ERROR* line of the S-100 bus to monitor external (S-100) boards for an error condition.

The optional slave 8259 interrupt (Level 3) allows access to the eight IEEE-696 interrupts generated on the S-100 bus, VIO*-V17*.



Internal view of Z-100, showing S-100 slots.

The Z-100 contains two integral serial ports (2661s), an 8253 counter/timer, and a 68A21 parallel port mapped at port addresses from 0E0H to 0FFH. Port addresses 0B0H to 0BFH are reserved for floppy disk operations, and ports addresses 0D8H to 0DFH are used for the video, light pen, and CRT controllers. Since the technical manuals mention that ports 0C0H to 0D7H are also "reserved" (lost to the decoding circuits, at least), this leaves port addresses 0 to 0CFH available for use on the S-100 bus.

The two serial ports are brought outside of the machine as RS-232 ports with DB-25 connectors. The parallel port mentioned above is used as a Centronics-type parallel printer port.

Floppy disk controller. The floppy disk controller is a card that plugs into the Z-100's S-100 bus. Why Heath chose to put the disk controller on an S-100 card is a mystery to us. Maybe they didn't have enough room on the motherboard. Whatever the reason, the board is fully IEEE-696 compatible and has several other nice features, too, including: user-selectable port address, programmable step rates, and independent $5\frac{1}{4}$ " and 8" write precompensation adjustments. The board also allows up to four $5\frac{1}{4}$ " drives and four 8" drives at the same time, although current software only supports two $5\frac{1}{4}$ " and two 8" maximum. Single- or double-sided drives are allowed, and the $5\frac{1}{4}$ " drives can be either 48 or 96 tpi. The 1797 floppy controller IC's data and interrupt request lines can be connected to S-100 vectored interrupt lines, if desired. (The board comes set up to work in a Z-100, so naturally, the interrupt lines are already hooked up.) The floppy controller board can also be bought separately, and used in any other S-100 system.

As it comes from the factory, the Z-100 is set up to handle two built-in $5\frac{1}{4}$ " floppies, and one or two 8" floppies that plug into a standard 8" drive expansion connector on the back of the machine.

S-100 expansion bus. A complete five-slot fully IEEE-696 compatible S-100 bus is built into the back of each Z-100. Because the floppy disk controller takes up one of the five slots, only four are available for external use. If it is desired to add additional memory (beyond 196K) to the Z-100, S-100 memory boards can just be plugged in. In fact, most any S-100 board can just be plugged in, with minimal hassle. We were able to use several boards, including a PMMI modem, and various IEEE-696 memory boards with no problems. Eleven connector cutouts, in various sizes, are provided in the back panel of the Z-100 for additional I/O connectors from added S-100 bus boards.

Software

Two operating systems are available from Zenith for the Z-100; Z-DOS (which is actually MS-DOS) for the 8088 processor, and CP/M-85 (which is plain vanilla CP/M 2.2) for the 8085 processor.

Z-DOS performed perfectly with all of our generic MS-DOS programs, including several compilers, utilities, and test programs. Z-DOS did not perform well with many IBM-PC programs, particularly those which made calls to specific IBM devices, like the IBM PC version of dBASE II. If you choose software that operates under MS-DOS only, you should have no problems. If you see the error message "Wild interrupt," then you are probably running

The Z-100 has something even more interesting than its 8085/8088 hardware: a five-slot S-100 bus.

a piece of software that does not use generic MS-DOS calls. More than 20 utility programs are provided with Z-DOS, including the standard MS-DOS utilities, and much more. The I/O configuration program is particularly nice, since it allows the user to set up all I/O baud rates and handshaking simply and quickly. It is so complete that it even draws a picture of the back panel of the Z-100 on the screen and *points* to the proper plug for whatever I/O you are using! A utility called RDCPM is provided to copy CP/M files to Z-DOS, but no similar utility is provided to go from Z-DOS to CP/M.

CP/M-85 also worked well in all of our tests. Disk I/O was faster than we expected, possibly because most of the BIOS functions are handled by the 8088, which uses full-track buffering. Because of the 8088's involvement, the BIOS is extraordinarily complicated, but, fortunately, there is very little reason to want to modify it, because of the very versatile configuration programs provided with CP/M-85. The set-up programs are similar to those provided with the Z-DOS O/S, with various differences, including configurable autoloader features, I/OBYTE assignment, and default mapping. Interestingly, the CP/M-85 I/O configuration includes an option for a Votrax board. The TPA available is 61K, which should be more than adequate for most CP/M applications. Complete source for the CP/M-85 BIOS is included.

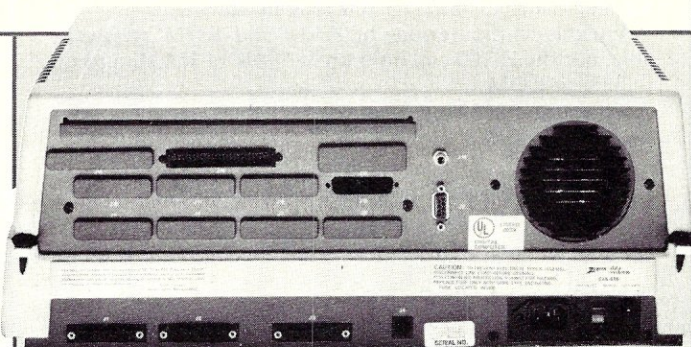
Several exceptionally good utilities are provided with both operating systems, including the various configuration programs mentioned for setting up printer and serial device protocols, selecting physical devices, etc. Quite a few printers are supported in the printer set-up programs, including the Diablo, MX-80 parallel or serial, HZ25 (of course), H14, T1810, DecWriters, and various others.

A "starter" package is available from Heath/Zenith that includes Z-DOS, CP/M-85, MultiPlan, and ZBasic. MultiPlan and ZBasic are both for use under Z-DOS. ZBasic, incidentally, appears to be very similar to IBM PC Basic. One of the local PC gurus tells us that it is IBM PC Advanced Basic, but we can't be sure.

The most frequent question asked about the Z-100 is "Is it IBM PC compatible?" As mentioned previously, as long as only generic MS-DOS programs are used, there should be no problem. Many software manufacturers already mark their products as Z-100 compatible. When in doubt, it is sometimes best to ask the manufacturer, and it is usually best to see the software work before you buy it. With the Z-100, software selection is helped by the fact that there are HeathKit stores all over the place, and they all carry Z-100 software. Zenith also publishes a list of third-party software vendors who support the Z-100.

Documentation

Heath documentation has long been considered a de facto standard in quality comparisons of documentation. The Z-100's documentation is no different. The manuals are clear, concise, well illustrated and voluminous. The Z-DOS documentation is contained in two entire manual sets, and includes a general introduction, a Z-DOS refer-



Rear view of Z-100, showing I/O connectors.

ence manual, a utilities manual, appendices, a glossary, and an index. The CP/M-85 documentation is also a two-manual set, that includes a complete set of the Digital Research manuals, a general introduction to CP/M, and a CP/M Reference Guide. In all, about 500 pages or so.

All manuals are high quality, typeset, multicolor, and contained in custom ring-binders. Sections are clearly marked, and important points and facts are boldfaced or printed in different colors and sizes for clarity and easy reference.

A demo disk is included that demonstrates some business graphics and some general graphics techniques, including line and circle drawing, charts, bar graphs, and multicolor pie charts. The graphics programs are written in ZBasic, so you can list them out to figure out what's going on.

An optional set of manuals, called the *Z-100 Technical Manuals*, is highly recommended. These manuals contain complete hardware information, including schematics, detailed theory of operation of each assembly, set-up information, floppy drive information, troubleshooting, programming information, and much more. In addition, a complete copy of the IEEE-696 specifications is included, along with the Intel iAPX 88 (8088) manual and complete data sheets for all of the major ICs inside the Z-100. Finally, a 1½" thick book of Z-100 BOOT ROM SOURCE listings is included, for those who have a lot of spare time. We would highly recommend these manuals if you are considering doing any programming on the Z-100, or want to know how the Z-100 works.

Complaints

Although we were generally impressed with what we saw, we did have a few small complaints. First, in the early version we received, the 8" floppy drive capability wasn't working, so we couldn't perform any 8" drive tests. Second, the Centronics parallel port on the back of the Z-100 is brought out to a DB-25 type of connector, which means that you'll need a special cable to connect a printer to your machine. We think it would have been just as easy to bring the Centronics signals out on a Centronics-style connector, and quite a bit easier to use. Finally, we would like to see a utility to allow transfer from Z-DOS disks to CP/M-

The Z-100 offers the advantages of both the popular 8-bit CP/M (with its incredibly large software base), and those of the new, more powerful, 16-bit world.

The world's largest selection of cross assemblers!

All 2500AD assemblers and cross assemblers support these features:

Relocable Code—the packages include a versatile Linker that will link up to 400 files together, or just be used for external reference resolution. The Linker allows Submit Mode or Command invocation.

Large File Handling Capacity—the Assembler will process files as large as the disk storage device. All buffers including the symbol table buffer overflow to disk.

Powerful Macro Section—handles string comparisons during parameter substitutions. Recursion and nesting limited only by the amount of disk storage available.

Conditional Assembly—allows up to 248 levels of nesting.

Assembly Time Calculator—will perform calculations with up to 16 pending operands, using 16 or 32 Bit arithmetic (32 Bit only for 16 Bit products). The algebraic hierarchy may be changed through the use of parenthesis.

Listing Control—allows listing of sections on the program with convenient assembly error detection overrides, along with assembly run time commands that may be used to dynamically change the listing mode during assembly.

Hex File Converter, included—for those who have special requirements, and need to generate object code in this format.

Plain English Error Messages—

These 2500AD products are available:

	Z-80 CP/M	ZILOG SYSTEM 8000 UNIX	IBM P.C. 8086/88 MSDOS	IBM P.C. 8086/88 CP/M 86	OLIVETTI M-20 PCOS
8086/88 ASM			\$99.50	\$99.50	
8086/88 XASM	\$179.50	\$750.00			\$179.50
Z-8000 ASM		750.00			299.00
Z-8000 XASM	179.50		179.50	179.50	
Z-80 ASM	49.50				
Z-80 XASM		500.00	79.50	79.50	79.50
Z-8 XASM	79.50	500.00	79.50	79.50	79.50
6502 XASM	79.50	500.00	79.50	79.50	79.50
6800,2,8 XASM	79.50	500.00	79.50	79.50	79.50
6801,03 XASM	79.50	500.00	79.50	79.50	79.50
6805 XASM	79.50	500.00	79.50	79.50	79.50
6809 XASM	99.50	600.00	99.50	99.50	99.50
8748 XASM	79.50	500.00	79.50	79.50	79.50
8051 XASM	79.50	500.00	79.50	79.50	79.50

Subtotal \$ _____ \$ _____ \$ _____ \$ _____ \$ _____

Name _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone _____ Ext. _____

Make and model of computer system _____

☐ C.O.D. (2500AD pays C.O.D. charges)

☐ VISA or MasterCard #, Exp. Date (mo./yr.) _____

TO ORDER. Simply circle the product or products you want in the price columns above, enter the subtotal at the bottom of that column and add up your total order. Don't forget shipping/handling.

Check one:

☐ 8" Single Density shipping/handling
☐ 5 1/4" Osborne (\$6.50 per unit) \$ _____

☐ IBM P.C.
☐ Cartridge Tape **Total Order** \$ _____

CP/M is a registered trademark of Digital Research, Inc.

Signature _____

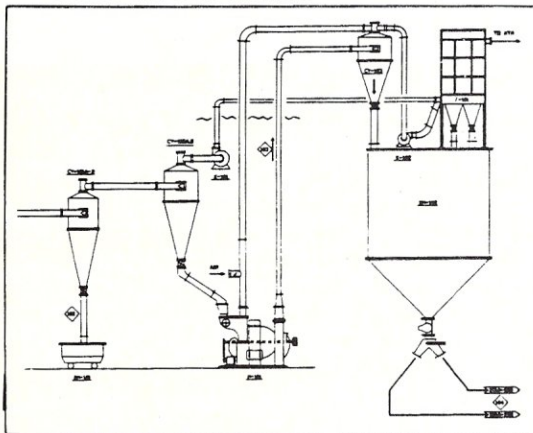
25004D SOFTWARE INC.

P.O. Box 441410, Aurora, CO 80014, 303-752-4382

CIRCLE 83 ON READER SERVICE CARD

YOUR S-100 PLUS OUR M-1000/S = CAD

M-1000/S CAD subsystem for S-100 includes 512 x 480 color graphics display, digitizer, plotter, all interface boards and cables and RGB monitor.



APPLICATIONS

P & ID

Process flow diagrams
Vessel drawings
Architectural drawings
Facilities planning
Plot plan and layout

Two-dimensional drafting and design software from Autodesk Inc. is fully installed, configured and supported by MOMS.



MOMS COMPUTING

Dealer inquiries invited.

Building 1055 Fort Cronkhite, Sausalito, California 94965 415 331-2043


CIRCLE 99 ON READER SERVICE CARD

Zenith Z-100 continued . . .

85 disks. It seems reasonable, since a utility is provided to transfer from CP/M-85 to ZDOS.

Conclusions

The biggest advantage of the Z-100 is that it is a complete system that is still expandable for a user's needs. It offers the advantages of both the popular 8-bit CP/M operating system with its incredibly large software base, and the new, more powerful, 16-bit world. In addition, it offers the advantage of the expandable S-100 bus system for those who need it, and a complete stand-alone machine for those who don't. Moreover, it is well built, well documented, and dependable.

Z-100 desktop model (13 1/2" h x 19 1/2" w x 19 1/2" d) with built-in monochrome monitor (screen available in amber, green or white): Kit, \$2,349; A&T, \$3,599. Z-100 low-profile model (7 1/8" h x 19 1/2" w x 19 1/2" d) with monochrome graphics: Kit, \$2,199; A&T, \$2,899. Monochrome monitor recommended: High-resolution ZVM-122, \$169.95 (12" display). To upgrade the Z-100 to color capability, two color video RAM chip sets are needed at \$145 per set. Configured for high-resolution color graphics, the Z-100 is: Kit, \$2,199, A&T, \$3,499. Color monitor recommended: High-resolution ZVM-135, \$649 (13" display). 

For more information, contact:

Heath Co.

Benton Harbor, MI 49022

(616) 982-3200

CIRCLE 324 ON READER SERVICE CARD

EMPROM-1: Eprom Emulator/Programmer

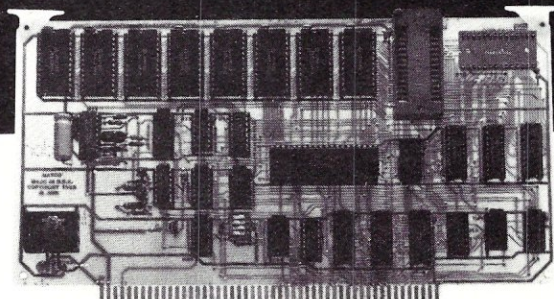
INTRODUCING the EMPROM-1

The MATCO Eprom Emulator/Programmer EMPROM-1 is a sophisticated tool designed to support the software engineer who routinely develops Eprom-based applications. It will emulate and/or program any of the currently available five-volt only MOS Eproms from the 2758 at the low end to the 27128 at the high end. The primary features are:

- Compatible with IEEE 696 S-100 standard
- I/O mapped—consumes no system RAM space
- 16K bytes of on-board emulation RAM
- Zero insertion force programming socket
- Complete with software: ■ runs under CP/M*, MP/M*, or CDOS** ■ menu driven program supports both programming and emulation ■ limited debugger type functions are provided ■ supplied in source code on 8" single sided soft-sectored disk.
- Incorporates the Intel fast programming Algorithm
- NO personality modules necessary
- Hardware provisions have been incorporated to allow programming of future 32K Eproms

The board may be purchased with a zif socket mounted on the board, or with a flat cable socket to connect to an external module.

Board with zif socket	\$305.00
Board with flat cable socket	295.00
External module + 4' cable	55.00



64K STATIC RAM Board is only \$395!

- Compatible with Proposed IEEE 696 standard
 - Total RAM/EPROM interchange capability (R/W jumpered)
 - Extended Address capability (A16-A23)
 - Global Addressing possible in 16K groups
 - Global/Extended allocations are 16K per group
 - 0-8 wait states for EPROM with fast CPU's
 - Wait states selectable on/off by 16K group
 - Responds to PHANTOM* on pin 67 (jumper selected)
 - MWRT generated on-board, or taken from bus
 - Automatic deselect of empty sockets via FF detector
- All boards are assembled, tested, burnt in and supplied with 150 nsec CMOS RAMS plus a 1 year limited warranty and owner's manual.

MASTERCARD VISA

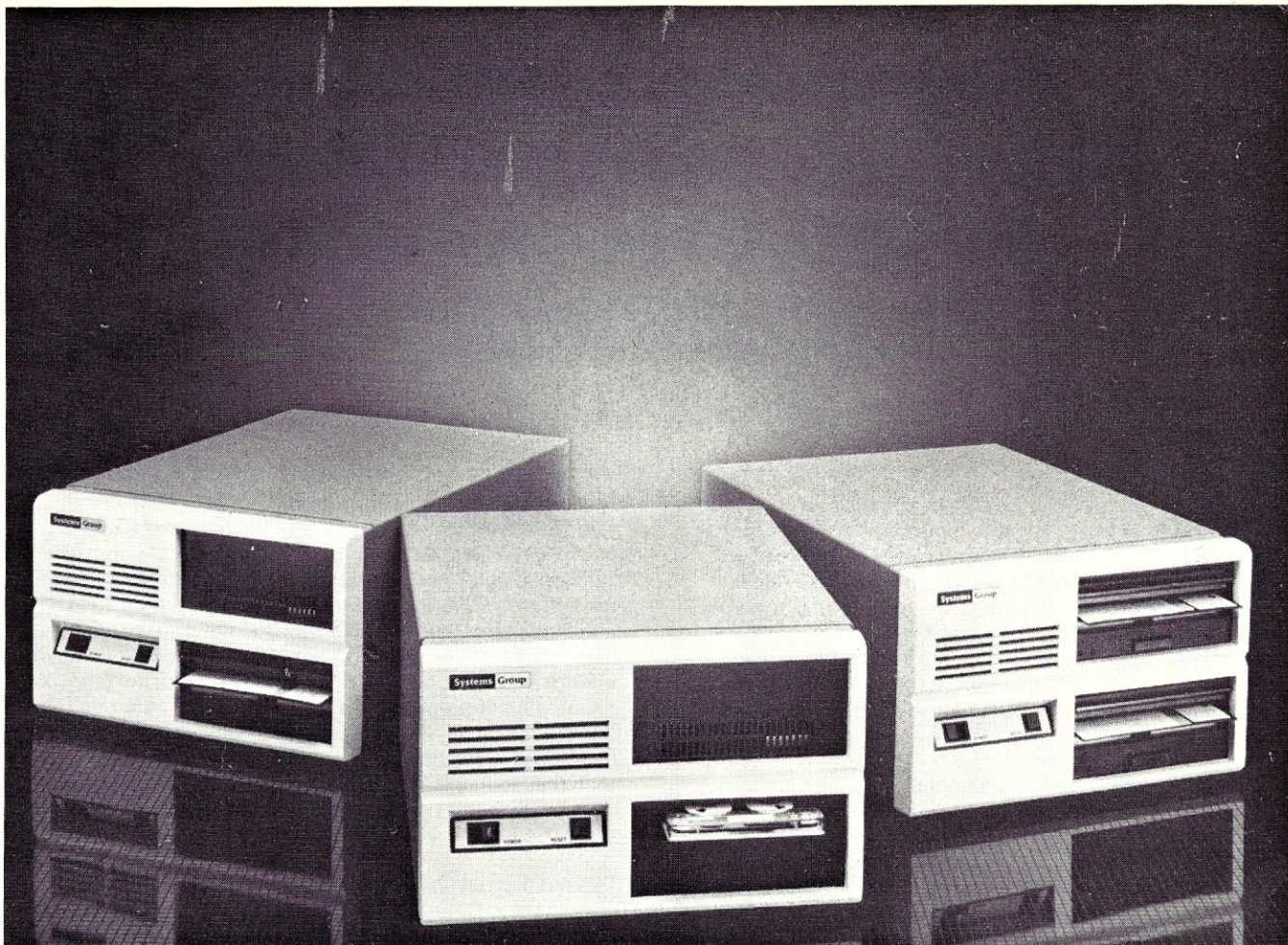
MATCO

Manufacturing and Test Company, Inc.

427 Perrymont, San Jose, CA 95125 (408) 998-1655

*CP/M and MP/M are trademarks of Digital Research Inc. **CDOS is a trademark of Cromemco, Inc.

CIRCLE 69 ON READER SERVICE CARD



THE MULTI-USER MICRO THAT REPLACES A MINI

Why buy a mini when you can have the big system features of the System 2900 microcomputer series? This versatile, multi-user IEEE 696/S-100 system can support up to eight users with existing popular operating systems like "Super" CP/M*, 14P/M* and "Fast" OASIS**. And as your requirements grow, so can the System 2900. When you consider the bottom line—COST PER USER—the system 2900 gives you mini performance at micro prices.

EXPANDABILITY

The System 2900 has built-in expandability. Its modular design allows configuration with com-

binations of floppy disks, hard disks and tape drives. For applications with big storage requirements, you can use multiple 12MB, 19MB or 40MB Winchester hard disks. You can upgrade the system easily by adding memory modules, I/O interfaces and mass storage subsystems. And with the System 2900, you have industry-standard peripheral and software compatibility.

VERSATILITY

The System 2900 gives you big-system choices in application software.

- Use System Group's high-performance versions of CP/M.

MP/M and OASIS to develop your own application software

- Take advantage of the variety of application packages for these operating systems
- Try the BUSINESS EXPRESS™ application development system, and use or customize its word processing and business application packages

Add to that a full one-year warranty on parts and labor for the entire system, **including drives**, and you have the Systems 2900 package. Designed to give you big performance at a micro price.

Join the Group. Systems Group.

* CP/M and MP/M are registered trademarks of Digital Research.

** OASIS is a trademark of Phase One Systems, Inc.

TM Business Express is a trademark of Measurement Systems & Controls, Inc.

Systems Group

A Division of MEASUREMENT systems & controls
incorporated

800-448-4888

1601 W. Orangewood Ave., Orange, CA 92668
Telephone (714) 633-4460

TWX/TLX 910-593-1350 SYSTEMGRP ORGE

CIRCLE 67 ON READER SERVICE CARD

Extended Memory Management for Older S-100 Computers

How one S-100 owner went about breaking the 64K barrier

by Andrew L. Bender

Got an older computer? Maybe an Altair or IMSAI? Want to modernize it? Interested in CP/M Plus? Multibanking? Then read on. I have an old IMSAI to which I am much attached (though I haven't given it a name) and which works fairly well as measured by the cover test. In case you don't know what a "cover test" is, let me explain: if you can keep the cover on your computer for a whole week at a time, its operation is "fair"; two weeks is "good"; three weeks is "fairly good"; and more than three weeks is "probably lying!"

I recently went to a local computer club meeting, where I heard all about CP/M Plus. Delighted by the introduction, I wanted to run CP/M Plus on my own machine, but at that time I owned only one bank of memory. While a single-bank CP/M Plus configuration does give some speed increase over 2.2, it occupies more memory space, and the reduced TPA may not be tolerable in some applications. Deciding to build a 3-bank system was not easy—it would be expensive, even if I used my existing memory boards, which were old and had no provision for extended addressing. However, it turned out that you can use older boards in such a system, provided that they have some means (such as the PHANTOM* line) for disabling the board under program control. I shall first discuss the basic requirements for extended memory management in an 8-bit system and a simple circuit to perform this function. Then I shall describe some additional circuitry needed for the control of older memory boards.

Extended addressing or bank switching?

Until the preliminary IEEE-696/S-100 standard appeared, memory was so expensive that few people even contemplated using more than 64K of memory in an 8-bit system. Thus, the early memory boards sometimes had a phantom circuit to disable them while the CPU was reading PROM bootstrap routines on a disk controller. As memory prices started dropping, some manufacturers began to incorporate provisions for bank switching. Each board contained an output port with a data latch, in which each bank number corresponded to one data bit; eight switches connected the enable line to one or more bits of the data latch. Thus, outputting a data word with, say, bit 2 set would cause a memory bank with switch 2 on to respond to memory read/write instructions. Any other memory bank would be deselected. This scheme allowed

up to eight banks to be addressed.

With the advent of the IEEE-696 standard (finalized and adopted last December by the Standards Committee), full decoding of the additional 8 extended address lines now allows a CPU to address up to 256 banks (i.e., 16 MB) of memory. But, because an 8-bit CPU has only 16 address lines, a memory manager is still required. However, since modern boards can decode the extended address lines, a common memory manager is usually located either on the CPU board or on a separate memory management board. The manager consists of a port address decoder and a data latch that activates the eight extended address lines. This is the type of circuit that I built for my CP/M Plus system on the IMSAI.

Simple memory management

If you have a prototype card which already has address decoding on it, such as the clock/calendar circuit described by Chris Terry in *Microsystems* Vol. 3, No. 2 (Mar/Apr 1982), the circuit in Figure 1 will provide extended addressing by adding just a few chips. The 8212 latch accepts data from an OUT instruction and transfers it to the extended address lines, where it remains until another OUT instruction is executed to the memory management port. The OS6* signal is an output strobe generated by the circuitry in Figure 4 of Chris Terry's article. This select line goes low whenever sOUT and pWR* are active, the proper 5-bit address is on lines A7 through A3, and the bit pattern "110" is on lines A2 through A0. The DS2 line on the 8212 is tied high so that the chip is always enabled when the DS1* line (driven by OS6*) goes low. The CLR* input is activated whenever pRESET* or POC* goes low, so that bank 0 is always enabled by turn-on or by hitting the RESET button.

There were some errors and omissions in the figures accompanying Chris Terry's article. In Figure 3 (page 62), the bus address line pins are reversed: the correct numbers are A3, pin 31, A4, pin 30; A6, pin 82; A7, pin 83. In Figure 4 (page 64), the connections of two address lines to U2 and U3 (74LS138s) are backwards: A2 should go to pin 3 of both ICs, and A0 should go to pin 1 of both ICs.

A complete memory manager circuit

If you do not already have address decoding and I/O strobe circuitry available, Figure 2 shows how to set up a complete memory manager. Address lines A7 through A2 are compared (in the 8131 6-bit magnitude comparator) to the outputs from a 6-position DIPswitch that sets the high-order bits to the desired base port address. The 8131 strobe input is grounded so that the chip examines all addresses. When the upper 6 address bits match the switch settings,

Andrew L. Bender, M.D., Neurological Services, Inc.,
336 Center Ave., Westwood, NJ 07675.

Amazing! This was Printed on an Epson

by The *Fancy Font*TM System from SoftCraft

Letter Quality

Say good-bye to correspondence quality and hello to *Fancy Font's* high-resolution, proportionally spaced, letter quality. *Fancy Font* provides fonts in sizes from 8 to 40 points; styles include Roman, Bold, Italic, Script, Old English, and more (see samples below). All this on low-cost Epson MX and FX printers.

Create Your Own Characters

You can use over 30 font sets in the *Fancy Font* package and furthermore, can create any new characters or logos you like, up to 1 inch by 1 inch. A database of over 1500 characters is included in the package.

Font Style and Size Samples

(actual size)

8 point Roman 10 point Roman 12 point Roman
18 point Bold 18 pt. Sans Serif
18 pt. Italic 20 pt. Script
20 point Old English

Easy-to-Use

Fancy Font is a *software* package for CP/M and IBM PC compatible systems; no special hardware or installation is required. With *Fancy Font* you use your favorite editor or word processing package to create a file to be printed. Include as few or as many formatting directives as you desire. Then use *Fancy Font* to print your file.

Numerous Applications

Fancy Font customers are constantly discovering new applications. For example:

- Business and personal letters
- Custom forms, invoices, labels, signs
- Foreign Languages
- Mathematical Notation, Greek
- Super- and Sub-scripts
- View Graphs
- Custom Letterheads
- Resumes
- Articles for publication
- Entire newsletters, brochures
- Complete manuals, cover-to-cover
- Advertisements, including this one
- Invitations, place cards

SoftCraft, Inc. 8726 S Sepulveda Bl Suite 1641 LA, CA 90045 (213) 821-8476

IBM & CP/M order now (213) 821-8476 M/C, Visa welcome.

InfoWorld
Software Report Card

Fancy Font

	Poor	Fair	Good	Excellent
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of Use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Error Handling	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

"The quality of print is excellent, and the variety of type styles and sizes is even better."

InfoWorld 5/2/83

Now available for Gemini 10 and 15 printers.

Copyright 1983 by Popular Computing, Inc., a subsidiary of CW communications, Inc. Reprinted from InfoWorld. NOT PRINTED BY FANCY FONT

SoftCraft 8726 S Sepulveda Suite 1641 LA, CA 90045

(Epson or IBM printer with Grafix required)

Fancy Font System \$180.00
 Fancy Font Demo Diskette \$10.00¹
 California Residents add 6.5% sales tax
 Outside US add \$10 (\$2 demo) postage
 Mail check or money order to SoftCraft

Diskette Format

☐ 8" CP/M ☐ QX10 ☐ Osborne ☐ KayPro
☐ IBM MSDOS² ☐ Victor 9000² ☐ Apple CP/M³

¹\$7.50 applicable towards purchase of Fancy Font

²MSDOS requires 128K memory

³fully transparent 8 bit printer interface required

INCLUDES THE FULL HERSEY CHARACTER DATABASE. CHARACTERS CAN BE SCALED TO ANY SIZE.

THIS ENTIRE AD WAS PRINTED ON AN EPSON MX80 PRINTER AT THE ACTUAL SIZE SHOWN.

CIRCLE 58 ON READER SERVICE CARD

Extended Memory Management continued . . .

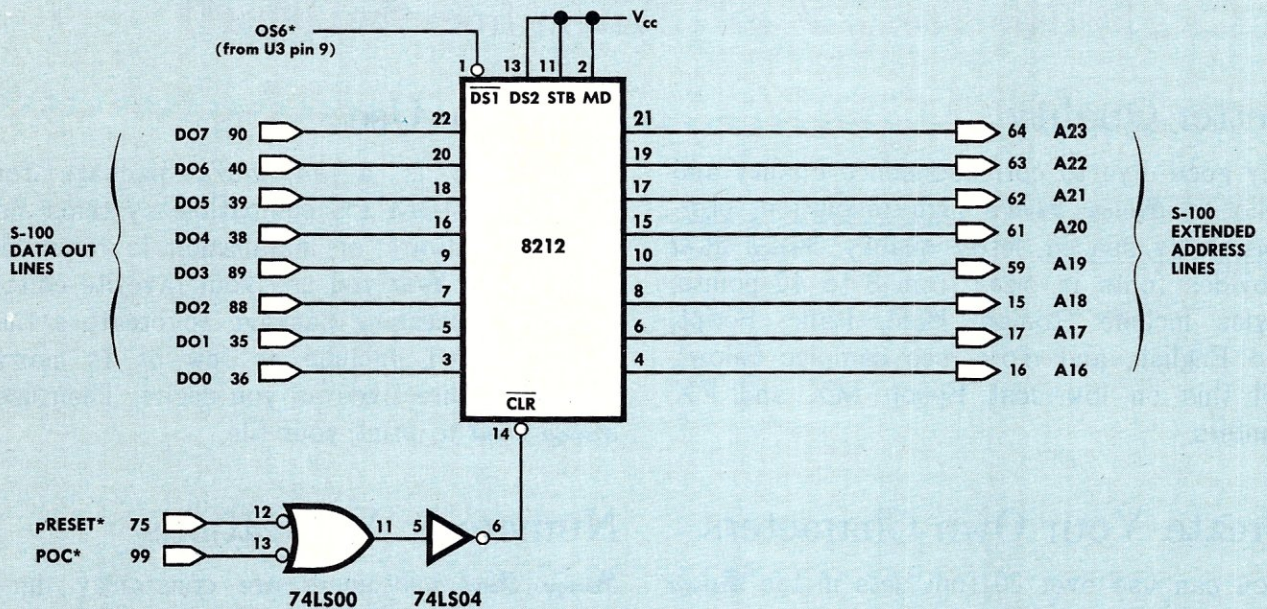


Figure 1. Simple memory manager (for Chris Terry's clock circuit).

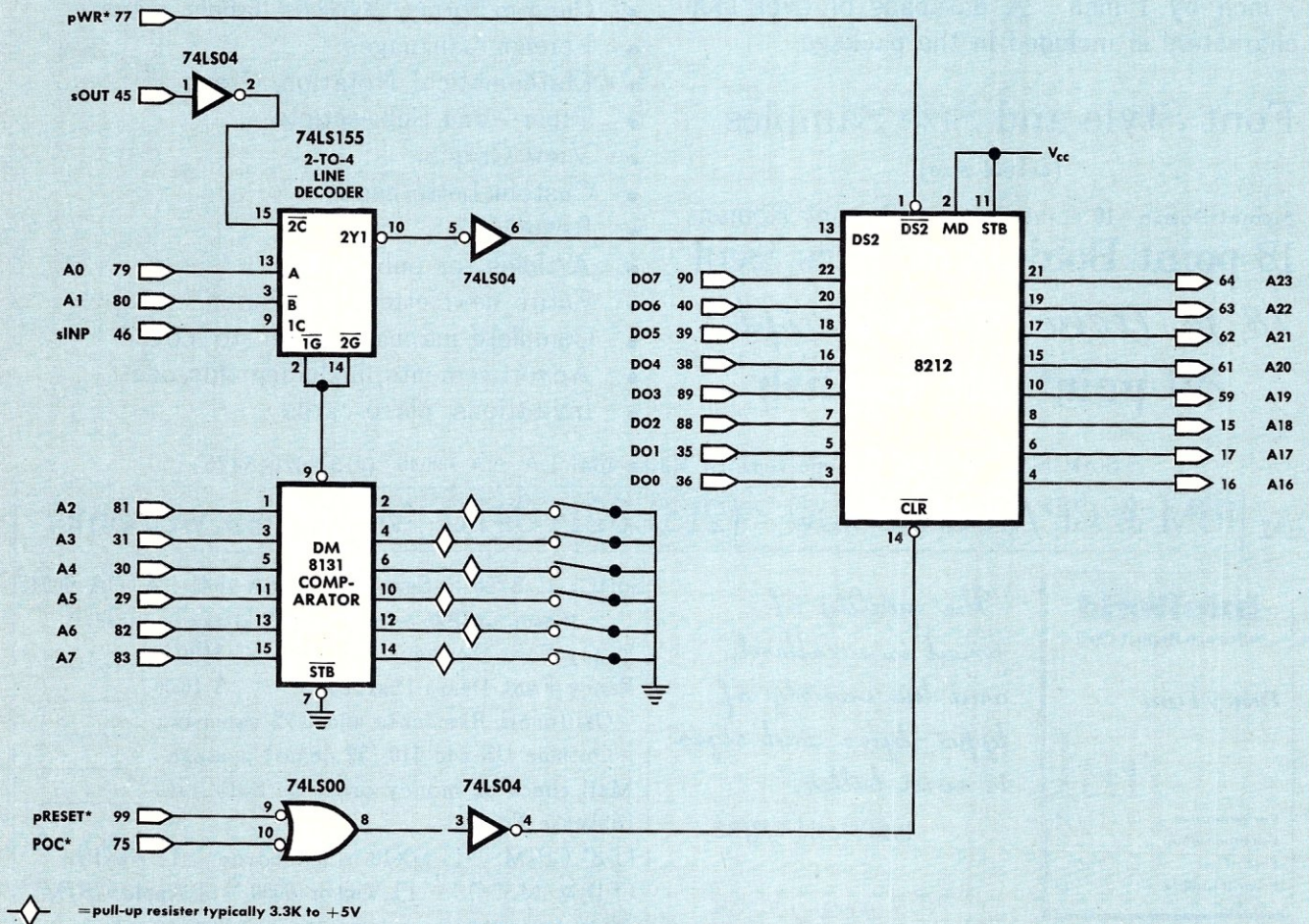


Figure 2. Complete memory manager.

Eco-C Compiler

Since November of last year, we've been testing our new Eco-C Compiler and now it's ready for your Z80™ CP/M™ system. Some of the features include:

- All data types, including float, double and long.
- Fast, efficient code. For example: Our versions of "seive" in January, 1983, BYTE; 15.8 seconds (standard) and 11.7 seconds (optimized).
- Uses Microsoft's MACRO 80™ for REL file output.
- Standard (K&R) file I/O and library (most in source) included.
- Easy assembly language interface.
- No royalty fees on generated code.

The price for Eco-C is \$350.00 and includes MACRO 80 (a \$200.00 value by itself). We'll also include a free copy of C Programming Guide while supplies last.

For further information, call or write:



P.O. Box 68602
Indianapolis, IN 46268
(317) 255-6476



Registered trademarks are: Zilog (Z80), Digital Research (CP/M), Microsoft (MACRO 80) and Eco-soft (Eco-C).

CIRCLE 154 ON READER SERVICE CARD

EE/EPROM PROGRAMMERS & UV ERASERS

AFFORDABLE ★ RELIABLE ★ AVAILABLE

PROMPRO-7™ - \$489.00
PROMPRO-8™
\$689.00



UV ERASERS
QUV-T8/1
\$49.95
*HOBBY
QUV-T8/2N
\$68.95
*INDUSTRIAL
QUV-T8/2T
\$97.50
*WITH TIMER
& SAFETY SWITCH
GANGPRO-8™
\$1,295.00
(GANG PROGRAMMER)

RS-232 serial, STAND ALONE, INTELLIGENT

*EASY DUPLICATION *USER FRIENDLY *128K BUFFER

SUPPORTS: MOST 8K, 16K, 32K, 64K, 128K, 256K EPROMS

PROMPRO-8: KEY PAD OPTION, EPROM SIMULATION MODE

Microcomputer Chips: 8748 (H), 8749H, 8750, 8751, 8741, 8742, 8755A

SOFTWARE DRIVERS: MDS ISIS, TEKTRONICS 8002, IBM PC, ATARI,

APPLE II, CPM, FLEX, TRS-80

DIRECT HOOK UP TO ANY DUMB TERMINAL OR COMPUTER.

DISTRIBUTOR INQUIRY WELCOME.

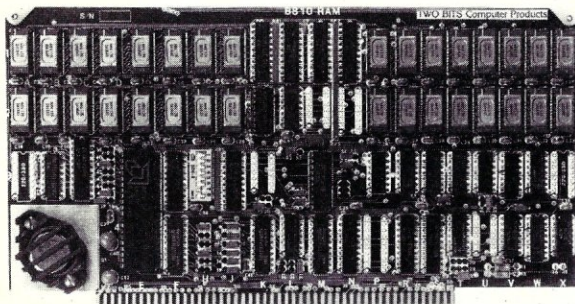
LOGICAL DEVICES INC.

1321E N.W. 65 Place, Ft. Lauderdale, FL 33309
Phone Orders (305) 974-0967 TWX 510-955-9496

CIRCLE 191 ON READER SERVICE CARD

OLD! EXPERIENCED AVAILABLE

The B810/A 256K Dynamic Memory System



FEATURES

- 8/16-Bit Operation
- 24-Bit Extended Addressing
- Port Selection
- FAST! 6MHz & Up
- Memory Mapping
- 5 48K User Banks/Board
- Virtual Memory & Semiconductor Disk Applications

The B810/A RAM is the most cost-effective solution for S-100 systems requiring reliability and speed at remarkably low cost. Qualified in a wide range of commercial, industrial and military applications, the B810/A has a 3-year history of field use in some of the harshest environments imaginable without a single failure. Optimized for Z80/Z8000* CPUs, the B810/A is, quite simply, the fastest and most reliable dynamic memory available.

Multi-layer board with full ground and power planes assures noiseless, glitch-free operation. No buried signal traces. **Quality:** Screw machine contact sockets. Workmanship per MIL-STD-454E. Quality that meets or exceeds MIL-I-45208. Packaging per MIL-81795. Type II. 100% AQL with

dynamic testing in environmental chambers at 80°C.

Protection: One Year Warranty (three years for Validated Boards). Upgrades for revisions made during warranty protects the user's investment.

Compatibility: IEEE-696 standard, the B810/A operates with any Z80 S-100 CPU and supports Oasis*, MP/M*, CP/M 3.0*, TurboDos*, Cromix*, Unix* and other operating systems.

Support: Extensive applications engineering support is available for systems integrators and OEMs.

Pedigree: The B810/A is not a new product. Introduced in 1981, it has been field tested for three years — the end product of experience gained at over 200 beta test sites.

*Oasis is a trademark of Phase One; CP/M and MP/M are trademarks of Digital Research; TurboDos is a trademark of Software 2000; Cromix is a trademark of Cromenco; Unix is a trademark of Bell Labs; Z80 and Z8000 are trademarks of Zilog.

\$895

Recommended retail
A&T with One Year Warranty
Technical Manual \$25
OEM and dealer inquiries invited.
Further information on request.



TWO BITS
Computer
Products

(805) 489-6733

235 Tally Ho Road, Arroyo Grande, CA 93420



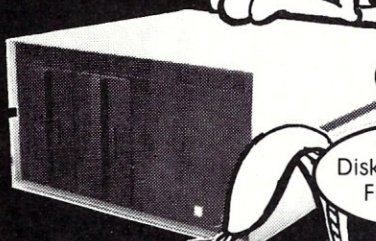
CIRCLE 74 ON READER SERVICE CARD

Main/Frames Main/Frames

from
\$175

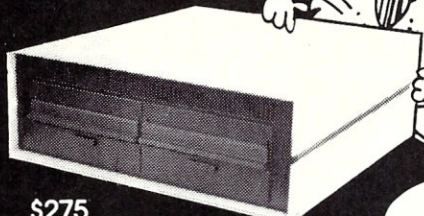
- 70 Models of Enclosures
- Assembled and tested
- Quasi-Coax Motherboards
- Power Supply
- Card cage and guides
- Fan, line, cord, fuse, power & reset switches

Wow!
70 Models!



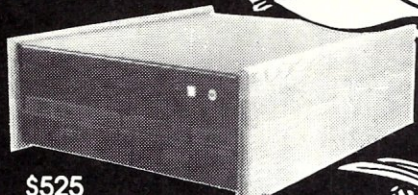
\$499

8" Floppy Main/Frame



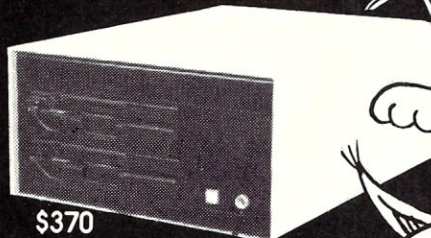
\$275

8" Disc Enclosure



\$525

Phase/80 8" Floppy Main/Frame



\$370

Slim Line 8" Floppy Main/Frame

Write or call for our
brochure which includes our
application note:

"Making micros, better than
any ol' box computer"

INTEGRAND

8620 Roosevelt Ave. • Visalia, CA 93291
209/651-1203

We accept BankAmericard/Visa
and MasterCard

Disk Enclosures
From \$100

MORE BANG
FOR THE BUCK

32 Page
Free Fakt
Pakt Catalog

CIRCLE 49 ON READER SERVICE CARD

At Last! bds C... Ver. 1.5

Including a new dynamic debugger
Still the choice of professionals

- Compiler option to generate special symbol table for new dynamic debugger by David Kirkland. (With the debugger, the distribution package now requires two disks.)
- Takes full advantage of CP/M® 2.x, including random-record read, seek relative to file end, user number prefixes, and better error reporting.

V 1.5 \$120.00

V 1.46 \$115.00
(needs only 1.4 CP/M)

Other C compilers and
C related products
available . . . Call!

TERMS: CHECK,
MONEY ORDER, C.O.D.,
CHARGE CARD
HOURS: 9 am—5 pm
Monday—Friday
(316) 431-0018

- Glint option to suppress warm-boot
- New library file search capabilities
- New, fully-indexed 180 page manual
- * CP/M is a trademark of Digital Research, Inc.

IT'S HERE! MONEY MATH

- Uses BCD internal representation.
- You choose from two types of rounding.
- Configurable exception handling
- Distributed with 12 digits precision. Easily configured for more or less
- Excess 64 exponents

SOURCE INCLUDED **\$50.00**



Dedicated Micro Systems, Inc.
P.O. Box 481, Chanute, Kansas 66720

CIRCLE 89 ON READER SERVICE CARD

MicroScript™ \$99

State of the Art Text Formatter

- extensible generic markup
- multiline headers, footers, and footnotes
- automatic widow and orphan suppression
- automatic section numbering
- automatic bullet, number, and definition lists
- floating and inline figures
- left, center, right, or justify text alignment
- left and right indentation with delay and duration
- bold, underscore, and proportional spacing
- macros and symbols
- multiple input files of unlimited size
- direct printer control
- format preview
- IDS, Qume, Diablo, NEC, C.I.TOH, and all TTY
- table of contents, index
- multiple columns
- conditional processing

MicroEd™ \$49

Customizable Full Screen Editor

- full cursor control by character, word, or line
- position to top or bottom of window or file
- scroll by line, half window, or full window
- global or selective find and replace
- delete by character, word, line, or block
- read external files into current file
- copy, move, and write blocks of text
- insert, overlay, or wordwrap text
- all cursor addressable VDTs

Postpaid within U.S. & Canada, outside U.S. add \$5, CA residents add 6½%,
8" SS/SD CP/M-86*, 5.25" SS/DD PC-DOS.

VISA

MicroType™
6531 Crown Blvd., Suite 3A, San Jose, CA 95120
(408) 997-5026

Master
Card

* CP/M-86 is a trademark of Digital Research, PC-DOS is a trademark of IBM Corporation.

CIRCLE 157 ON READER SERVICE CARD

the MATCH* output goes low and enables the 74LS155 2-to-4-line decoder. This chip decodes the two low-order address lines (A1 and A0). The 74LS155 decoder has two halves, which I used to provide both input and output strobes. Note that the two halves are *not* symmetrical; one half requires an active-high signal, the other an active-low signal. The half that provides input strobes is directly enabled by sINP; the other half, that provides output strobes, is enabled by inverted sOUT. This allows the port address for the memory manager to be OFDH, which is a current de facto standard address for memory manager devices.

Modification for alternate bank-select boards

Memory boards such as the TDL Z-16 do not have any provision for extended addressing; however, they may have an alternate bank select line (ABX*) which, when low, keeps the first bank selected, but deselects the bank when high. Bursky's book gives schematics for many of the older boards of this type, and they can be used in Bank 0 by adding the circuit shown in Figure 3. I used pin 60 in my system because TDL had assigned it to ABX*. Check to see that the pin you use in your system is not assigned to any function that might cause a conflict.

Program to move data between banks

A demonstration program to test the bank select circuit is given in Listing 1. This program moves data between banks and must always reside in the global portion of

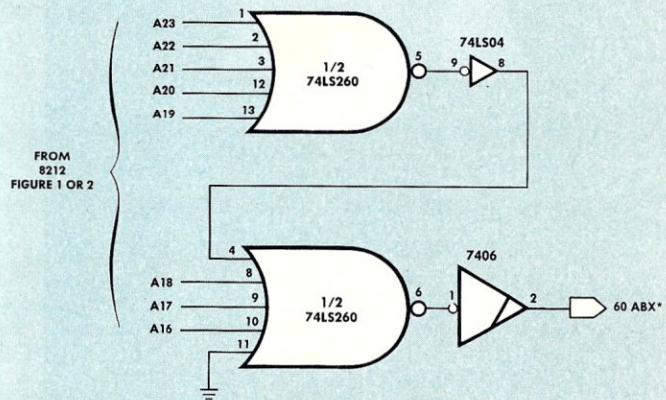


Figure 3. Modification for alternate bank select line.

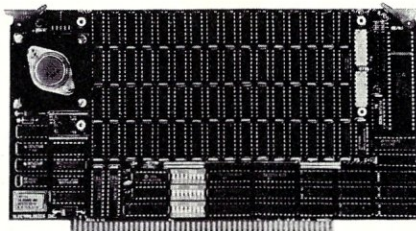
WAIT NOT, WANT NOT!

If you've been waiting for a disk emulator that can increase your system's throughput by as much as 50 times, the wait is over. QUASI-DISK is here!

QUASI-DISK is a high capacity, I/O mapped RAM board which acts like an additional disk drive on any S-100 system.

Here's what makes QUASI-DISK a better buy than the others:

- Fully S-100/696 compatible.
- **QUASI-DISK** offers 2 modes of expansion:
 - a) Chip capacity may be doubled with the addition of an add-on module.
 - b) Storage capacity may be increased to 4 Megabytes by replacing 64K RAMs with 256K devices.
- DMA compatible with transfer rates to 2 Megabytes/second.
- On board powerfail logic write protects disk during power failures.
- Optional battery back-up provides 2 hours of powerfail protection.
- External wall mount power supply allows system power to be switched off while data is retained indefinitely.
- Six layer printed circuit board improves performance and reliability.



GUARANTEE

Unique design guarantees that **QUASI-DISK** will perform as advertised, in standard as well as non-standard S-100 systems.
OR YOUR MONEY BACK

Manufactured by:

Electra™

— Incorporated —

- Requires only 6 I/O addresses to access entire board.
- Supports extended I/O addressing when enabled.
- On board 22 bit address generator may be programmed for auto increment or decrement if desired.
- Any sector size may be implemented.
- Onboard LED's indicate "drive active" and "powerfail status".
- Price includes installation software on 8" SS/SD diskette with all source code supplied.
- Sample CP/M* Bios routines are included for integration into any CP/M* system.
- **QUASI-DISK** is covered by a 1 year warranty and an extended warranty option is also available.

QUASI-DISK (512K) — \$799.00

Expansion Module

(additional 512K) — \$595.00

Back-up Battery (including wall mounting supply) — \$159.00

*CP/M is a registered trademark of Digital Research.

TIME SAVED IS MONEY WELL SPENT

A

Altos/ Apple II
 with Hayes Micromodem II/Avatar/
 Big Board/California Computer Sys-
 tems 2710/and 2719/Casio/Cromemco/
 CompuPro/DEC VT-180//Eagle II/
 Eagle III/Eagle IV/Escort/Exxon 500/
 Godbout System Support Board/
 Godbout Interfacer 3/Interfacer 4/Hayes
 Micro-modem 100 or 80-103A/Imsai
 SI02-2/Intertec/Ithaca/Kay Pro II/Lobo
 Max-80/Monroe OC 8820/Morrow De-
 cision 1/Morrow Micro Decision/
 Northstar Advantage/Northstar
 Horizon/Osborne I/Otrona/PMMI
 MM-103A/Radio Shack Model II,
 Model 12/Sanyo MBC-1000/Sanyo
 MBC-1250/Sanyo MBC-2000/Sierra
 Data Sciences ZS10/Teletex/Tele-
 video/ Vector 3/
 Vector 4/ Xerox 820/
 Xerox 820-II/Zenith 89/Ze-
 nith 90/Zenith 100/Zenith 110/
 Zenith 120/ Zorba and more.

Z

MITE

The most flexible
 Data Communications Software
 you can buy.

\$150.00

Dealer and distributor inquiries welcome.

**MYCROFT
 LABS INC**

P.O. Box 6045, Tallahassee, FL 32314 (904) 385-1141

CIRCLE 171 ON READER SERVICE CARD

Extended Memory Management

continued . . .

memory common to all banks. Note that a Z80 machine cannot use a block transfer instruction to move data between banks. I have made the assumption that this program is called from another routine in global memory, so there are no problems as to which bank the stack is in. The banks must be switched for each byte transferred. On entry, register pair HL points to the source address, register pair DE points to the destination address, B contains the number of the source bank, and C contains the number of the destination bank.

References

Bursky, D., *The S-100 Bus Handbook*. Hayden Book Co, Rochelle Park, NJ, 1980.

Lancaster, D., *CMOS Cookbook*. Howard Sams Publishing Co., Indianapolis, IN, 1977.

Lancaster, D., *TTL Cookbook*. Howard Sams Publishing Co., Indianapolis, IN, 1975.

Libes, S. and Garetz, M., *Interfacing to IEEE-696/S-100 Microcomputers*. Osborne/McGraw-Hill, Berkeley, CA, 1981.

Robison, J., "A Timestamp for CP/M" (Letter to the Editor), *Microsystems*, Vol. 3, No. 4, Jul/Aug, 1982.

Terry, C., "A Timestamp for CP/M" *Microsystems*, Vol. 3, No. 2, Mar/Apr 1982.

Andrew L. Bender practices neurology amid a complete collection of obsolete S-100 systems that are being used as space heaters.

Single Board Computer



**6 MHz
 Z80**

DSB-4/6 is Fast, Powerful and Compact

- 4 MHz Z80-A* or 6 MHz Z80-B* Processor and I/O
- Full DMA for Both 5 1/4-inch and 8-inch Disk Drives
- High Speed Bi-directional Parallel Port
- 4 RS-232 Serial Ports (110-38,400 baud)
- Centronics Type Parallel Printer Port
- 64K of RAM and 2K of ROM

Davidge Corporation
 1951 Colony Street, Suite X
 Mountain View, CA 94043
 (415) 964-9497

* Z80 is a registered trademark of Zilog

CIRCLE 96 ON READER SERVICE CARD

INTRODUCING
PERFORMICS
PROBLEM
SOLVERS

THE FASTEST S-100 CPU/MEMORY COMBINATION AVAILABLE !

MAKE NO MISTAKE ! Before PERFORMICS developed the *PRIVATE ACCESS BUS*, to run an INTEL 80286 on the S-100 bus you had to slow it down by 50%. Hard to believe ? Consider the following :

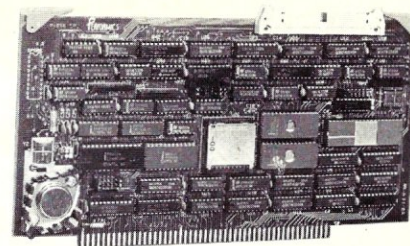
The IEEE-696 spec defines a bus cycle to be three clock ticks in duration

+

INTEL defines a bus cycle for the 80286 to be two clock ticks

=

Poor performance unless you choose PERFORMICS' problem solvers with the *PRIVATE ACCESS BUS*



PRIVATE ACCESS BUS

FEATURES :

P-286

- 80286 CPU
- Programmable Interrupt Controller
- Three 16 Bit Timers Cascadable
- Dual Ported Architecture (S-100 + *PRIVATE ACCESS BUSSES*)
- Socket for 80287 Math Processor Running Independent Clock (Option)
- Two Jedec 28 pin sockets for up to 64K EPROM/ROM

FEATURES :

P-128

- 128K CMOS Static RAM
- Addressable on 64K Boundaries
- Battery Backup (Option)
- Dual Ported Architecture (S-100 Bus + *PRIVATE ACCESS BUSSES*)
- Cascadable
- No Wait State Operation with P-286

S-100 BUS

"Private Access Bus + S-100 = THE WINNING COMBINATION"

If you are going to pay for performance, insist on getting it. Call for pricing and details now !

PERFORMICS
INC.

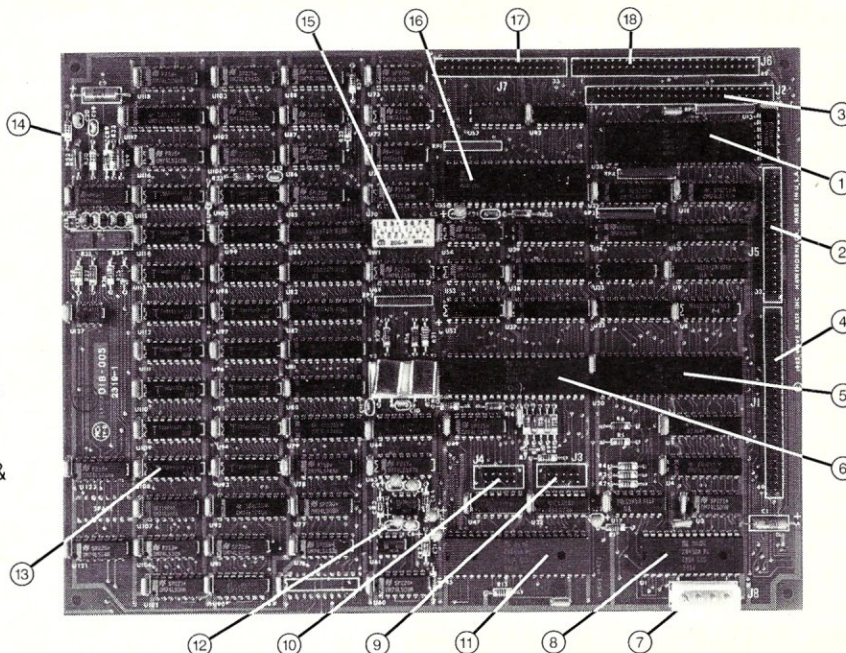
P.O. BOX 3207 • NASHUA, NEW HAMPSHIRE 03061 • (603) 881-8334
TELEX 294088 PERF UR

CIRCLE 34 ON READER SERVICE CARD

GET THE BEST FROM CP/M PLUS™ WAVE MATE *BULLET*™

Outstanding Features:

- 128K RAM. 256K optional
- 4MHz Z80
- Enhanced C-BIOS
- DMA controller. Second DMA operation optional
- Power only 5v @ 2a.
- Only 8 x 10.7 inches in size
- Centronics parallel printer port.
- SASI hard disk interface
- Interrupt-driven I/O
- DMA Floppy Disk controller for both 5 1/4 & 8"
- Optional 16K EPROM
- 2 RS232 serial ports. 4 ports optional; synchronous or asynchronous
- DMA expansion bus



- ① Printer/Winch Port
- ② Printer Conn.
- ③ Winch. Conn.
- ④ Exp. Data Bus
- ⑤ CPU Chip
- ⑥ DMA Chip
- ⑦ Power
- ⑧ Clock Timer Cont.
- ⑨ First Serial Port
- ⑩ 2nd Serial Port
- ⑪ SIO
- ⑫ Charge Pump
- ⑬ 128K RAM
- ⑭ Data Separator
- ⑮ Boot Disk Setter
- ⑯ Floppy Disk Contr.
- ⑰ 5 1/4" Floppy Conn.
- ⑱ 8" Floppy Conn.

WAVE MATE INC.
14009 S. Crenshaw Blvd.
Hawthorne, CA 90250
(213) 978-8600 Telex: 194369



WAVE MATE INTERNATIONAL
159 Chee de Vleurgat
1050 Brussels, Belgium
Tel: (02) 649 10 70 Telex: 24050

CIRCLE 177 ON READER SERVICE CARD

Nevada Fortran from Ellis Computing

For \$29, how good is it?

by David L. Dupuy

Some of us grew up with Fortran and still find it very useful, mainly because of its speed, familiarity, and general availability on main-frame computers. All this, despite the purists who look down on Fortran these days! Among CP/M users, Microsoft F80 Fortran is pretty well the standard, but at \$350, one is likely to pause carefully before ordering. Hence when I saw Nevada Fortran from Ellis Computing advertised for \$29.95, I was intrigued. But at \$29, how good is it?

The \$29 price tag reminds us of the recent discussions concerning \$29 Pascal. Curiously, as someone has already said in these pages, the price of software these days often bears no relation to its quality. I recently purchased the \$29 Fortran, and the purpose of this article is to convey my reactions after using it for a couple of months. This review should give you a feeling for the general capabilities of this Fortran—which you may not be able to glean from the ads—and help you decide if you want to purchase it or not.

To quickly summarize my reactions: for \$29, this software is remarkably good! Although slower for computations than other Fortrans, overall it is very capable Fortran. I heartily recommend it, especially at 1/12 the Microsoft price. But consider its limitations, discussed below, before you buy.

Documentation

For \$29, can the software *and* the documentation be acceptably good? In this case, yes! The manual is not intended as a Fortran primer (correctly so, in my opinion), but it does adequately document the features, structure, and use of Nevada Fortran. The manual has 137 pages, plus an additional 40 pages describing the Nevada Assembler, which is included in the \$29 package. The manual was obviously put together with a good word processor, and the top header carries a revision date of January 1982. The printing quality is great, and the manual is punched for a three-ring binder, then *bound* with a soft cover. Nice! There is a detailed table of contents, and the chapters are divided into the usual (useful) categories, e.g., number systems, control statements, arrays, I/O, etc. There are 13 appendices, and most are very useful, such as statement summary, standard and nonstandard functions (e.g., SIN, ABS, AMOD, etc.), system subroutines (e.g., CALL OPEN), and errors.

A number of examples are included for most items, but I personally would have liked at least twice as many, since I find examples the quickest way to learn. However, if one remembers that the manual is not intended as a Fortran primer, then one must concede that the number of examples is adequate. At the end of the manual there are several

sample programs, mostly to illustrate features not normally found in Fortran. For instance, there are sample programs for the TRACE ON and TRACE OFF statements, the CHAIN statement for chaining programs, the DUMP statement, the SEEK statement for random access disk I/O, and even sample programs for a simple graph routine and a Shell sort.

I have two negative comments about the manual: First, there is no index. I consider this an almost unforgivable omission, especially since a capable word processor appears to have been used. Surely it would have been only one day's effort to use the FIND command to root out all the references to, say, FORMAT or DIMENSION, etc. My other complaint has to do with the location of the installation procedure and other information for first-time users. All the details needed to configure the software for certain defaults and to compile a program are in Chapter 9 under the section "Getting Started," tucked away on page 84! It took me a while to find that the first night! Why not in the first chapter?

Aside from these two complaints, the manual is fairly complete and not hard to use. It's not organized as well as the DEC Fortran manual, but very few manuals are. There is a complete list of errors, good descriptions of system subroutines and functions, and most of the manual is logically arranged. I consider the manual a very positive factor

Table 1. Comparisons of computation speeds (in seconds)

	Microsoft Fortran	Nevada Fortran	Microsoft Basic
Pournelle benchmark	14	67	108
Eratosthenes prime numbers*	5.8	284	607

*10 iterations, 4K array elements

Table 2. Disk I/O benchmark times (in seconds)

Statement	Nevada	Microsoft
WRITE (8,20) (x(k),k = 1,4096)	23	182
WRITE (8) x	10	6

Table 3. Disk space for typical short program

Nevada		Microsoft	
JERRY.FOR	2K	JERRY.FOR	2K
JERRY.OBJ	2K	JERRY.COM	14K
(JERRY.REL	2K)	(JERRY.REL	2K)

David L. Dupuy, Dept. of Physics, Virginia Military Institute, Lexington, VA 24450

in the decision to purchase this software.

Structure and convenience of use

As mentioned above, the procedure to get a Fortran program running is covered in Chapter 9 of the manual (page 84). If you are accustomed to Basic, you have probably heard that Fortran is very clumsy to use, since it must be compiled, linked, and so on. It's certainly true that debugging a Fortran program can take longer because of the extra time in compiling. But the payoff is in compatibility with mainframe programs, runtime and other areas. If you are familiar with a mainframe Fortran compiler and operating system (e.g., the DEC compiler and linker), you will find that the Nevada Fortran is compiled a little differently. Here is an example for compiling a simple Fortran program named PGM.FOR under Nevada Fortran:

```
FORT PGM    compiles source code, produces intermediate assembly file PGM.HEX
FRUN PGM    runtime package executes program
```

Now you see one of the main structural differences between this and other Fortrans: there's no linker! Even if you have never used a Fortran compiler, you will find the Nevada procedure simple, and it may be quicker than compiling and linking (e.g., Microsoft Fortran). For most situations, the absence of a relocating linker (sometimes called a linking loader) is no real disadvantage. (Read on—I have to justify that statement!)

An important use for linking a subroutine is to interface to an assembly language subroutine, e.g., for tasks that require speed or outputting to a port, or other tasks that are simpler to do in assembly language. That capability is available with Nevada Fortran, and in fact, by several different routes. First, assembly language statements can simply be included in your Fortran source program with the inclusion of an asterisk, which means that these statements are assembled directly and not taken to mean Fortran statements. That could sometimes be far simpler than linking to a subroutine. Second, there is a CALL routine (a function of the form `A = CALL (parameters)`) that allows assembly language programs to be CALLED and to be passed an argument. The starting address in memory is specified in this CALL function, and another Fortran statement is used to get your assembly language program into memory, the CALL LOAD system subroutine. Finally, FUNCTIONS and SUBROUTINES written in Fortran can be used as usual, but they must be included at the end of your program and compiled with the main program. The COPY filename statement is probably useful here: the file specified is inserted and you do not have to retype your favorite subroutine at the bottom of each new program.

There are all the usual compile options to make life easy for you. The general form of the compile command is

```
FORT U:PGM.LAO $OPTIONS
```

where FORT is the Fortran compiler, U: is the drive where the source code (PGM) is found (if not present, the default drive is assumed), L is the drive to receive the list file (PGM.LST), and A is the drive for the final object program. There are the usual useful options for LAO, such as "do not generate a PGM.LST file", etc., and there are useful defaults. For example, "FORT PGM" compiles and as-

sumes the default drive for everything. For OPTIONS, one finds N (no assembly or object files), P (paginate the list file), blank pad the source statements to either 64 or 72 characters, and several others having to do with COMMON blocks.

Incidentally, I found the Nevada Fortran to be as accurate in trigonometric functions as other implementations. For example, the result of $\sin^2 x + \cos^2 x$ (which should equal 1) was 0.99999998 (an error of 2 parts in 100 million). No other checks were made on the number of digits of accuracy.

Computation and I/O speed

I fully realize that benchmarks are a sensitive subject, but I would like to give you an idea of the computing and I/O speeds. The tests with Nevada Fortran were performed on my CompuPro S-100 system, which has a Z80 CPU (CPU-Z) running at 6 MHz and a Shugart 801 8" disk drive with the CompuPro DISK1 controller. I am indebted to Dr. Arne Henden for running the Microsoft Fortran for these comparisons on his S-100 system.

A comparison of computational times first. I ran Jerry Pournelle's benchmark (BYTE, October 1982, page 254), which I translated from Basic into Fortran. I also ran the Eratosthenes Sieve prime number benchmark (Gilbreath and Gilbreath, BYTE, January 1983, page 286). The results of these tests are shown in Table 1, and execution times in Microsoft Basic are shown for comparison. For the prime number program, I could not use an array with 8K elements with the Nevada Fortran because of the way all Nevada Fortran numbers are stored (6 bytes per digit). Therefore all three prime number benchmarks were run with 4K elements, and that should be taken into account if these times are compared with the Gilbreath and Gilbreath results. It is clear that Nevada Fortran is significantly slower in these computations than the Microsoft Fortran, but still faster than interpreter Basic.

Since I write numerous data files to disk, I was very interested to see how quickly Nevada Fortran handled this chore. I wrote a simple I/O intensive program to test this, and this program is given in Listing 1. The line "WRITE STATEMENT GOES HERE" was first replaced with a formatted write statement: `WRITE (8,20) (x(k), k=1, 4096)` and then with a unformatted write statement: `WRITE (8) x`. The resulting times are shown in Table 2. Note the PAUSE statement; the timings did not include computation times. The Nevada Fortran is considerably faster than the Microsoft on formatted I/O, and virtually the same on unformatted I/O. (Remember that these timing comparisons were obtained on two different computers, and slightly different times would likely result if these comparisons were run on the same computer. Nonetheless, I feel this rough comparison is useful.)

Incidentally, if you are perpetually short of floppy disk space for user files, the Nevada Fortran will give you an advantage. The disk storage requirements for the Pournelle benchmark are shown in Table 3. The two files in parentheses can be removed after successful compilation, and then, for the same program, the Nevada system requires 4K of disk space, while the Microsoft version requires 16K. This is true because of the Nevada runtime package, which has been excluded in Table 3 (analogous to keeping the Microsoft compiler on your disk). This is also

***Even if you have never used a Fortran compiler,
you will find the Nevada procedure simple,
and it may be quicker than compiling and linking.***

the reason the runtimes are longer for the Nevada Fortran, because of the runtime interpretation.

Features and details

In this section I intend to list some of the enhancements, omissions, and details in this Fortran. First of all, at this price, something must have been left out. There was, of course, and on page 118 in the manual is found a clear list of enhancements and omissions with respect to the ANSI 66 standard. Perhaps the most serious omissions are (1) the lack of any double precision computations or functions (that could be important for some types of scientific computations), and (2) the lack of complex numbers, statements, and functions. The other ANSI 66 features not implemented seemed less important to me for most computing. For example, there is no EQUIVALENCE statement, no D or P format specifications, no extended DATA statement of the form DATA A,B,C/1,2/3/, and a couple of other minor items.

There are numerous useful enhancements, i.e., things you cannot do in ANSI 66 Fortran. Some of the enhancements were undoubtedly required because no linking loader was available, as discussed above. For example, assembly language routines can be written in directly, with an asterisk to alert the assembler to assemble these statements directly. There is also a COPY statement to insert source files into a Fortran program. Those two features make the Fortran viable without a linking loader. In addition, a CHAIN subroutine is available to load and execute another program. Also, a CALL LOAD subroutine can be used to load a PGM.HEX or PGM.OBJ file into memory under program control, and a CALL function then causes execution of this code, passing an argument if desired.

In addition to the usual formatted and unformatted (binary) I/O, a free-form I/O is available. This is similar to the free-form I/O found in DEC Fortran and on other mainframes these days. For example, the TYPE and ACCEPT statements need no formatting, e.g., TYPE 'The answer is', ANS outputs the string and variable to the console, and ACCEPT 'Input value for XMAX:', XMAX prompts the user on the console and then reads in the value. A more flexible free-form I/O is available with the usual READ and WRITE statements: WRITE (1,*) x writes to logical unit 1 (the console) and needs no format statement. The free-form READ is similar: READ (6,*) (x(k), k=1, npts) would read from a disk file. With these you can avoid the FORMAT statements if you wish. The usual CALL OPEN and CALL CLOSE subroutines are available, with an optional error parameter that can even convey the reason for the I/O error, such as "disk is full" or "end of file encountered". A REWIND statement positions the pointer to the beginning of the file, and the

BACKSPACE will backspace the logical unit specified by one record. The CALL OPEN (8,'LST:') sends output directly to the printer. You can even delete and rename disk files *under programs control* (CALL DELETE and CALL RENAME). Very useful and easy-to-use I/O statements!

Finally, there are several powerful features that should appeal greatly to those interested in using Fortran for instrument control and real-time experiments. Here's one you won't find in ordinary Fortran: the CALL DELAY (wait time) implements a delay up to 635 seconds, with a resolution of 0.01 seconds. That's much easier programming than most of the assembly language clock calls that I've seen! The CALL OUT (part, value) outputs an 8-bit number to any port you specify, and there is a corresponding A = INP (port) to input data from a parallel port (these two are not exclusive to Nevada Fortran). One of the most useful system subroutines is the CALL BIT (arg), which allows the setting, resetting, flipping, or testing of individual bits in a variable. If you don't like assembly language and are using a parallel port for instrument I/O, this one feature could save you weeks of programming time! There is also a RAND (arg) function for random numbers (not in Microsoft Fortran). And if you like structured programming, you can use the IF . . . THEN . . . ELSE construct.

Conclusion

After living with and using the Nevada Fortran for a couple of months, I conclude it is a remarkable bargain at \$29. If you feel you would like to learn Fortran but cannot justify the \$350 price tag, you no longer have an excuse. For the engineer or scientist, there are several enhancements that make this high-level language easier to use than most for instrument interfacing or real-time control. It is significantly slower than Microsoft Fortran in computations, but faster than interpreter Basic, and as fast or faster in disk I/O operations. The only significant ANSI 66 features not present are the lack of double precision capabilities and complex numbers; if you do not need these, then I think you will find Nevada Fortran completely satisfactory.

Nevada Fortran is available for \$29.95 plus a \$4 shipping charge from:

Ellis Computing
3917 Noriega St.
San Francisco, CA 94122
(415) 753-0186

CIRCLE 321 ON READER SERVICE CARD

Listing 1. Program for I/O timings

```
dimension x(4096)
do 10 k=1, 4096
  10 x(k) = k
  pause 'Begin?'
  call open (8, 'DATA.DAT')
  WRITE STATEMENT GOES HERE
endfile 8
write (1,1)
1 format ('All Done.')
```

Comments from Ellis Computing

Since this review was written, version 3.0 (released June 1983) has appeared. Many features that the author of this review criticizes have been changed in the new version. Part 1 of the manual has been expanded to 166 pages and contains an index. Three or four examples are now given for every command, and some of the commands have been rewritten to be more meaningful. Ten to 15 more sample programs have been added to the section at the end, and the installation procedure and other information for first-time users has been put in Chapter 1. Part 2 now has 46 pages and includes an index. The new version also has a double precision statement, although it is treated as single precision.

NEVADA

FORTRAN™

"If you want to learn or teach someone FORTRAN, this is the package to buy." *ACCESS*, March/April 1983.

Perfect for teaching FORTRAN. Perfect for learning FORTRAN. Perfect for Scientists and Engineers. Based upon the ANSI-66 standards (FORTRAN IV), advanced features include IF...THEN...ELSE constructs, COPY statement, CHAINING with COMMON, TRACE style debugging and 150 verbal error messages. What's more, you can intermix in-line FORTRAN and Assembly Language statements for those special Micro needs! Get yours today. Diskette comes with 214-page manual.

NEVADA

PILOT™

Why has Nevada PILOT become so popular? It's definitely easier to learn than BASIC. The documentation (114 pages) by Professor Starkweather is exceptional! And, it meets all the PILOT-73 standards with many new features, including a built in full-screen text editor.

Perfect for training, testing, virtually all programmed instruction and word puzzle games. Order yours now! Diskette and manual come with 10 FREE programs.

NEVADA

EDIT™

"A well-thought-out product with excellent documentation and an astoundingly low price." *Microcomputing*, May 1983.

Now, high quality text editing for micros. Nevada EDIT is great for program editing, as it was designed specifically to create COBOL, BASIC, and FORTRAN programs. It's a character-oriented full-screen video display text editor.

Simple to configure. You can customize tab stops, default file type, keyboard control key layout, and CRT by menu selection.

CP/M is a registered trademark of Digital Research, Inc. TRS-80 is a registered trademark of Tandy Corp. Apple II is a trademark of Apple Computer, Inc. Osborne is a registered trademark of Osborne Computer Corp. Xerox 820 is a trademark of Xerox Corp. Kaypro is a trademark of Non-linear Sys. Heath/Zenith is a trademark of Heath Corp. IBM is a trademark of International Business Machines, Corp. Nevada COBOL, Nevada FORTRAN, Nevada PILOT, Nevada EDIT and Ellis Computing are trademarks of Ellis Computing, Inc. © 1983 Ellis Computing, Inc.



SINCE 1977

ELLIS COMPUTING™

CIRCLE 97 ON READER SERVICE CARD

NEVADA

COBOL™

Nevada COBOL is based upon the ANSI-74 standards with many advanced features. It's field-proven with thousands of users world-wide in Business, Government and Education. The excellent documentation (165 pages) is used as a classroom text at a number of colleges.

Because of Nevada COBOL's superior design, it requires about half the memory of competitive COBOL compilers. This major advantage is just one reason many business programmers are switching to Nevada COBOL.

And, lots of students are using Nevada COBOL because it's the affordable, easy-to-use COBOL! Order yours now!

Also available: COBOL Application Packages, Book 1, \$9.95.

Nevada FORTRAN and Nevada COBOL are now available for the Commodore-64 from Commodore Business Machines, Inc.

To make our software available to even more micro users, we've slashed our prices. What's more, we're offering a money back guarantee. If for any reason you're not completely satisfied, just return the package—in good condition with the sealed diskette unopened—within 30 days and we'll refund your money.

This is a limited time offer, so order yours today!

\$29.95
each

MAIL TODAY! TO: Ellis Computing, Inc.
3917 Noriega Street
San Francisco, CA 94122
(415) 753-0186

The CP/M® Operating System, a 8080/8085/ Z80 microprocessor, and 32K RAM are required.

Software Packages:

☐ COBOL ☐ FORTRAN ☐ PILOT ☐ EDIT ☐ BASIC

Diskette Format: 8" ☐ SSSD (Standard IBM 3740 format)

5 1/4" ☐ Apple CP/M ☐ Xerox 820 SD ☐ Osborne SD

☐ Televideo ☐ Micropolis Mod II

☐ North Star DD ☐ North Star SD

☐ TRS-80 Mod I with CP/M @ 4200 hex ☐ TRS-80 Mod I/Mapper

☐ Heath Hard (Z-89) ☐ Heath Soft (Z-90)

☐ Superbrain DD DOS 3.X (512 Byte sectors)

☐ Kaypro DD ☐ DEC VT-180 ☐ Epson QX-10

☐ NEC PC 8001 ☐ Sanyo ☐ Access

Shipping/Handling Fees: Add \$4.00 for the first package and \$2.00 each additional package. OVERSEAS add \$15.00 for first package and \$5.00 each additional package. Checks must be in U.S. funds and drawn on a U.S. bank!

Send my order for _____ packages @ \$29.95 each Total _____

COBOL Applications package @ \$9.95 each Total _____

in CA add sales tax _____

☐ Check enclosed Shipping/handling _____

☐ MasterCard ☐ Visa Total _____

_____ Exp. Date _____

Signature _____

Ship to Name _____

Street _____

City/State/Zip _____

Some Notes on Microsoft Fortran-80

by Robert S. Minnis

Fortran-80, Microsoft's Fortran for CP/M, is a very good product. In addition to the compiler and built-in subroutine library (F80 and FORLIB), the purchaser receives a linking loader (L80), a library manager (LIB80), a good relocatable macro assembler for Z80 as well as 8080 (M80), and a cross-reference generator (CREF80, which I have never used).

The price is reasonable: the list price is \$500, but I have seen it advertised as low as \$325 (although it is disconcerting that the cost for versions on Apple, Radio Shack, and some others is less than half the above discounted price for the CP/M version). I have owned version 3.34 of this product for about three and a half years, and have recently gained access to version 3.44 at work. Version 3.44 is the most current release. According to the Microsoft manual, "Updates to Fortran-80 are announced periodically and are available for a minimal charge." This was certainly true at one time, since my original version 3.2 was updated to 3.34 (paid for by the reputable dealer that sold me the package) soon after purchase, including a disk and new manual, through Lifeboat for \$30. However, when I recently inquired about the latest update, Lifeboat quoted a price of \$105, which seems more than "minimal." Microsoft's price is substantially less than that, but they will not provide updates directly unless the product was originally purchased from them. When I complained to Microsoft about the price difference, they said that their dealers could charge whatever they wished, and I should take any complaints to Lifeboat. In addition, Microsoft does not currently have a method of notifying owners of the availability of updates.

Nevertheless, even at \$500, the product is a real value.

The output of the compiler (and the M80 assembler) is a REL file (the file type is REL, for relocatable). The REL file is a compact object file that contains linking and relocation information. L80 is used to combine these files, along with routines in FORLIB and optionally with routines from a user-created subroutine library, into an executable memory image. A COM file or Intel HEX file may be produced, plus a SYM file for use with Digital Research's SID or ZSID symbolic debuggers. A program listing may be produced on the console, on the printer, or in a disk file (or may be omitted). The linker does not use disk work files, so significant memory (apparently about 12K) is unavailable for object code, though Fortran subsequently uses some of this memory for disk buffers and FCBs during execution, or the memory may be used dynamically by user-written routines.

The package appears to be very clean. However, there are a few problems of which the user should be aware, including at least one fairly serious bug.

First the bug. One of the nicest features of Microsoft's implementation of Fortran, particularly on memory-strained micros and where speed is important, is the ability to define one-byte integer variables (by use of the INTE-

GER*1, LOGICAL*1, or BYTE statement). Unfortunately, the one real bug that I have found in the package is right in the middle of this nice feature. It seems that in doing one-byte integer comparisons in which one of the variables is negative, such as in

```
IF (I .LT. J) ...
```

the test fails for many combinations of I and J. In particular, for the "less than" comparison, if I is negative, then the test fails when J is greater than or equal to $-128 + I$. For the "greater than" comparison, if I is positive, then the test fails whenever J is less than or equal to $-128 + I$. The range of values of a one-byte integer is -128 to 127 .

By calling Microsoft's technical support department, I found that they were well aware of the problem. I was told that the problem probably will be fixed in the next release (date unavailable at this time). Since the problem exists in both versions 3.34 and 3.44, and that the time span on these versions is over three years, I am not going to hold my breath (even if I could afford the cost of the update). Fortunately, most of my use of single-byte integers is restricted to positive values, and this is the reason I only recently encountered the problem (at least as far as I know!). Unfortunately, as with update availability, Microsoft has not implemented a method of notifying owners of their packages about known bugs.

The second problem is actually the result of attempting to fix a problem in earlier releases. In 3.34, formatted output to disk files uses the first character of each output record as carriage control, just as for console or printer output. This first character is used to determine line spacing, and is not placed in the disk record. For single spacing, the most common case, each disk record is terminated in a carriage return (CR), followed by a single linefeed character (LF). If the carriage control character calls for double spacing, then two linefeeds follow the CR; skip to new page results in a formfeed character; a request for overprint results in CR only.

A serious problem with this is that every record, *except the first*, has one or more extra characters at the beginning (the CR is interpreted as the end of the record). Any attempt to read these records in character format, using the format codes A,H,X, or literal (single quotes surrounding the appropriate number of blanks) will misread either the first record or all except the first. The various format codes perform differently. Interestingly, using numeric format codes seems to work properly, as if the leading control characters were not there. Microsoft's solution, apparently beginning with version 3.36, is to stop using carriage control specifications in disk files, simply terminating each record with a CR only.

There are several difficulties with this solution. First, if TYPE is used to list the file, all you get to see is the last record. Similarly, using control-P to produce a printed list, on printers that do not perform an automatic linefeed on return, results in overprinting all lines. If the disk file is created with another program, including most editors, it cannot be processed properly by Fortran programs. Or if the file created with F80 is to be processed by a program

Robert S. Minnis, 1213 Hopkins Dr., Denton, TX 76201

that requires the linefeed, that program will not function properly. Finally, one cannot produce a formatted output to disk for later printing. Of course each Fortran program could explicitly output linefeeds and formfeeds at the appropriate points, but this is really a pain.

After complaining about both the initial problem and the solution, you are probably asking if I have a better answer to propose. I believe that I do. Fortunately, the source for the disk driver is provided as part of the package. My solution, on version 3.34, is simply to ignore the first leading linefeed on each record, if any. Implementing this fix requires about five lines of code added to the formatted read routine in the disk driver, which I was able to add before I really even knew 8080 assembly language. In version 3.44, however, the fix is more complicated, since the code to process carriage control characters must be reinstalled in the formatted write routine, as well as putting in the above-mentioned change.

Another minor annoyance also concerns disk file processing. When a disk file is read or written to, say to unit 9, the default file name used is FORT09.DAT. But F80 also provides an explicit OPEN routine, allowing the user to associate a specific filename with a logical unit number. This is a very important capability, but the OPEN routine provided is not very smart. It does not check that a valid filename has been passed, and if invalid, CP/M will obediently create the file, which then cannot be processed by most commands or programs, and cannot even be erased. (If by chance either the filename or file type part is valid, then a wildcard-type erase often can be used.) In addition, it is very easy to enter an invalid name to OPEN because the name must be exactly eleven characters, with the filename and file type parts each padded with blanks if not eight or three characters, respectively. For example, 'DATA_____X_____' for file DATA.X.

While converting from the external user form of the name to the format required by CP/M is not trivial, it sure would have been nice if this function had been provided. OPEN is actually part of the disk driver routine, and this could be modified by the user, but I chose to implement file name checking and formatting in a separate routine (written in Fortran, again thanks to those one-byte variables).

It should also be noted that when performing sequential output to a file, any existing file of the same name will be erased without notice. Therefore it is not possible to add data to the end of an existing file. This is true for sequential type output only; direct access writes will modify an existing file, or add records to the end.

The final problem I would like to discuss is not really a bug, but more a deficiency in implementation. Sure enough, Fortran's history is that of 80-column cards and fixed-length records. However, recent implementations for use specifically in an interactive environment certainly should be expected to remedy as many shortcomings as possible. A case in point in F80 is the situation in which it is necessary to read character strings that by nature are variable in length. If the maximum record size is 40 characters (a name, say), then each record must be padded with blanks to the full 40 positions. Both disk files and console input must be padded in this manner. I have heard this problem mentioned several times as a near-fatal failing of Fortran when used interactively. It would be highly desirable for the input routines to pad unfilled positions with blanks. This is not done in F80, but there is a simple and

relatively painless solution. The I/O routines maintain an external variable named \$BL, which contains the number of bytes transferred by the last I/O operation. Listing 1 is a function subroutine, written in assembler, to return this one-byte value. It also is possible, through some trickery, to retrieve \$BL with Fortran subroutines. (see Listing 2). In either case, the function is referenced by

```
LEN = IOLEN(0)
```

The (0) is not actually required, but avoids the necessity of declaring the function as EXTERNAL. The function should be called immediately following the READ for which the length is needed, but certainly before a subsequent I/O operation. The value returned is minus the terminating carriage return.

Listing 3 is a subroutine, using IOLEN, which pads a variable to a specified length. Note that the above is not a problem when reading numeric variables, such as with I, F and E format codes; any variables "off the end" of the record are zeroed automatically.

I would like to conclude by discussing a few of the really nice features of this package.

At some point between 3.34 and 3.44, L80 was changed to reset the disk system periodically. This allows changing disks at any prompt, including just before writing out the COM file. Nice improvement! By the way, this is not documented in the manual.

Another feature added at some point is the ability to include statements from another file in the compile (the INCLUDE statement). This can be useful for COMMON statements or other sequences of code that are not appropriate for implementing as subroutines. The same capability is provided in M80, and can be used for including macros from a library, as well as for normal source code.

Free-format input is another highly useful feature. If numeric data values in a record, on disk or from the console, are separated by commas, the values need not be located in the positions called for by the format. For example, consider the following read and format:

```
READ (1,10) I,J,K  
10 FORMAT (3I5)
```

Normally, this data record would be required:

```
____21____107____5
```

However, in F80, this record would also be acceptable:

```
21,107,5
```


The only apparent restriction is that the field widths specified in the format are in effect as maximum lengths. For example, (3I2) could not be used, since the second data value is three digits long. The format (3I7) would be acceptable, however. Also, A format codes must be used with caution when mixed with numeric codes, since commas are valid character data and will not serve as separators.

Finally, statements are provided that allow moving data to and from variables (arrays) using formats, just like in reading and writing records (the ENCODE and DECODE statements). This facility has many uses, and is particularly useful for converting to and from internal characters forms, and for effectively reading the same record multiple times and with different formats.

The above are just the best of several important features of this package.

Many people claim that Fortran is a dead language (or should be), but the Microsoft implementation provides a very useful and productive system. The compiler is fast and the resulting program, while slower than assembly

Many people claim that Fortran is a dead language (or should be), but the Microsoft implementation provides a very useful system.

language, is fast indeed. The linking process requires considerable time, but the savings and convenience in being able to use previously written and compiled routines more than makes up for this. With the judicious use of assembly routines, one can program just about any application desired using Microsoft Fortran. In fact, this article was produced using a word processing program I wrote, originally using only Fortran. I later rewrote certain routines in assembly for faster execution. 

More information on this product can be obtained from:

Microsoft
10700 Northup Way
Bellevue, WA 98004
(206) 828-8080

CIRCLE 349 ON READER SERVICE CARD

```

      TITLE      IOLEN  - GET LENGTH OF LAST FORTRAN I/O
      :
      : SAMPLE CALL:      I=IOLEN(0)
      :
      : 'IOLEN' IS AN INTEGER VARIABLE
      :
      ENTRY      IOLEN
      EXT        SBL

IOLEN:
      LXI        H,SBL      ;ADDR OF LEN
      MOV        A,M        ;GET LEN
      DCR        A          ;REDUCE FOR <CR>
      MVI        H,0        ;PUT IN INTEGER REGS
      MOV        L,A        ;<H,L>
      RET
      END
    
```

Listing 1: A function to return the length in characters of the last I/O.

```

      FUNCTION IOLEN (I)
      EXTERNAL SBL
      CALL SRECLN (SBL, IOLEN)
      RETURN
      END

      SUBROUTINE SRECLN (SBL, IOLEN)
      INTEGER*1 BL
      IOLEN = BL - 1
      RETURN
      END
    
```

Listing 2: Two Fortran routines to perform the same function as the assembly routine in Listing 1.

```

      SUBROUTINE PAD (STR, LEN)
      INTEGER*1 STR(1), BLANK
      DATA BLANK / ' ' /
      IF (LEN.LT.1) RETURN
      IL = IOLEN(0)+1
      IL (IL.GT.LEN) RETURN
      DO 1 I = IL, LEN
      STR (I) = BLANK
      RETURN
      END
    
```

Listing 3: A subroutine, using IOLEN, to pad a string with blanks. STR is assumed to have been read using A format codes. Variable LEN is the length of variable STR, in characters (bytes).

CP/M® Software

- A>DBPACK: Data base management; indexing, sort/search, tabulation, address labels ...
- A>DBPACK-II: Advanced data management; payroll, inventory, large & complex data bases ...
- A>COMCOM: Communication program; powerful, yet easy to use.
- A>CPMCPM: Transfer files (any type) between CP/M computers.
- A>FILER: Compresses, archives, catalogs & organizes files.
- A>UNERA: Recovers erased files.
- A>MULTED: Multi-file text editor.

CP/M is a registered trademark of Digital Research

Configured for a wide variety of systems.
Disk formats include 8-inch, Osborne, Xerox ...

Call or
write
for
information

COMPU-DRAW
1227 Goler House
Rochester, NY 14620
Phone: (716)-454-3188

Dealer
inquiries
invited

MasterCard, Visa & American Express cards welcome.
Separately ordered documentation may be returned
for full refund within 10 days!

It's the writing on the wall

CIRCLE 207 ON READER SERVICE CARD

Innovative Solutions For Real World Problems

The VIP*-100 Series offers a single card solution for your data acquisition and process control needs . . .

Combining A/D, D/A, Control I/O on one board for maximum cost-effectiveness and optimization of space. Choose the exact mix of functions you require from our line of six boards.

Series Features:

S-100 IEEE-696 Single Card A/D, D/A, Control I/O.

Analog portion includes 1-8 fully differential, high performance instrumentation amplifier inputs. Software configurable gain and offset. Programmable voltage and current source outputs which can be configured for 4-20mA operation. 12-bit accuracy. 3-25 μ s conversion time.

Digital portion includes 8 TTL-compatible inputs, 32-48 high voltage, high current (30V, 100mA) outputs. On board BCD-7 segment ROM decoder for easy LED display interface.

Other features include 2 DPST instrumentation relays, programmable self-test capability. Assembled and burned-in. Complete and easy-to-use instruction manual with applications software.

DEALER AND OEM INQUIRIES INVITED

AUTOMATED CONTROL SYSTEMS

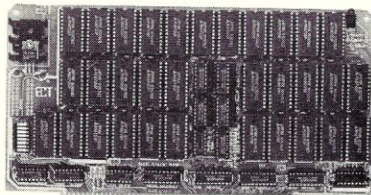
1105 Broadway
Somerville, MA 02144
617-628-5373

*VERSATILE INSTRUMENTATION PERIPHERALS

CIRCLE 200 ON READER SERVICE CARD

CUSTOM PRODUCTS

DESIGN • LAYOUT
MANUFACTURING

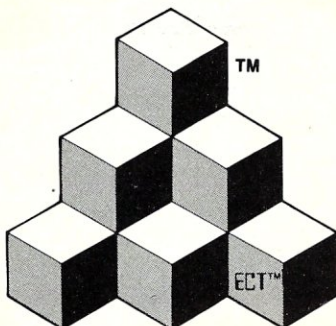


64K STATIC RAM
FULLY STATIC MEMORY

\$399

SPECIALIZING IN
QUALITY
MICRO COMPUTER
HARDWARE

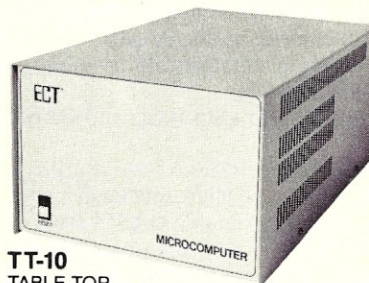
ECT™



**BUILDING BLOCKS
FOR
MICROCOMPUTER SYSTEMS,
DEDICATED CONTROLLERS
AND TEST EQUIPMENT**

CARD CAGES, POWER SUPPLIES
MAINFRAMES, CPU'S, MEMORY
I/O, OEM VARIATIONS

S-100 PRODUCTS



TT-10
TABLE TOP
MAINFRAMES

MULTIBUS® PRODUCTS

MULTIBUS IS A TRADEMARK OF INTEL CORP.

ELECTRONIC CONTROL TECHNOLOGY, INC.

763 Ramsey Ave. Dept. MS Hillside, NJ 07205 (201) 686-8080 Ext. 100

CIRCLE 56 ON READER SERVICE CARD

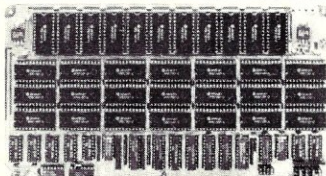
CHECK SUNTRONICS NEW LOW PRICES

S-100 Products

S-100 64K MEMORY BOARD

Assembled and Tested
without RAM

\$155⁰⁰



64KSM Assembled/Tested with 64k RAM (32-6116's)... **339.00**

The 64KSM is an outstanding value in S-100 Memory. Using the CMOS 6116P-3 (150nS) RAM chips, it runs at excess of 6MHz using less than 1/2 amp. Flexible bank select circuitry works with Cromemco, MP/M and CDOS. The 64KSM allows four (4) 16K banks to be used independently or connected as 16K and 48K, 32K and 32K or one 64K. 2716 system PROM's can replace one or all 6116 RAM chips. IEEE-696 interface works with Northstar, Morrow, IMS and many others. Works great with 8088 boards. 24 bit extended addressing with bank selecting allows more than 16 MB memory operating system.

UFDC-1 Floppy Controller, Assembled and Tested... **245.00**

The UFDC-1 Floppy Controller, Kit... **225.00**
The UFDC-1 Floppy Controller uses a WD1795 which runs either and/or 8" 5 1/4" Disk Drives. For detailed review see August 83 issue of *Microsystems*, page 76.

SBC-880 Z80A CPU, A&T... **\$169.00**

SBC-880 Z80A CPU, Kit... **149.00**

4MHz Z80A CPU boards with Serial and Parallel Ports. For a detailed review see the August 83 issue of *Microsystems*, page 76.

S-100 Prototype Board

Double Sided glass with gold plated, numbered S-100 terminals. Matrix of 25 x 78 solder plated donuts on .15" x .1" spacing. Locations for headers and regulators. Great for 14, 16, and 24 pin IC's.

SUN-721 S-100 Prototype Board... **12.95**

CLOCK CALENDAR A&T... **115.00**

CLOCK CALENDAR Kit... **95.00**

This S-100 Clock Calendar Board has 4 Interrupts, Day of Week, Time in 12 and 24 Hour formats, Month/Day/Year, Leap Year Register and On Board Battery Backup.

S-100 Edge Connector 100 pin... **3.95**

General Products

TERMINALS

TELEVIDEO 912 Terminal... **660.00**

TELEVIDEO 925 Terminal... **795.00**

TELEVIDEO 950 Terminal... **985.00**

ADDS VIEWPOINT 3A+... **545.00**

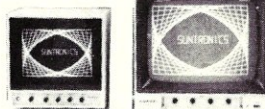
General Products-cont.

Mitsubishi Disk Drives, 5 1/4" and 8" Slim
5 1/4" Thin DSD 40 Track... **310.00**
8" Thin DSD 80 Track... **450.00**

DISKETTE SALE

5 1/4" Diskettes	10 up	100 up
SS/DD (100% certified)	1.75	1.55
DS/DD (100% certified)	2.50	2.30

Video Monitors



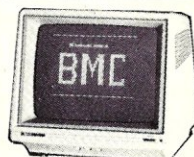
SAMWOO GREEN 9" 18MHz... **\$115.00**

SAMWOO AMBER 9" 18MHz... **119.00**

SAMWOO GREEN 12" 18MHz... **124.00**

SAMWOO AMBER 12" 18MHz... **127.00**

Composite video I/O. 750 lines resolution. 75/10K ohm impedance.



BMC 13" COLOR monitor for your home computer/video game display. Offers 350 x 350 resolution with 400 dots at the center. 9191U 13" Color... **249.00**

BMC 13" RGB COLOR monitor offers state of the art RGB for the IBM PC with 690 x 240 resolution and latest in TTL level technology. 9191MU 13" RGB Color... **445.00**

Note: Please add \$10.00 shipping and handling for the video monitors.

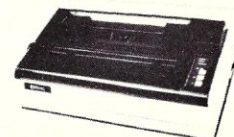
TOLL FREE 1-800-421-5775

(ORDERS ONLY)

Calif. orders and all Info Call 213-644-1149

General Products-cont.

BMC PRINTERS



BX-80 dot matrix printer with 80 cps, 9 x 7 print head. Quiet, reliable and priced for entry level end-user... **\$269⁰⁰**

PB401 16 cps letter quality bi-directional daisy wheel printer. 132 cpl with cassette type ribbon... **731.00**

BMC PB101 16 cps letter quality bi-directional daisy wheel printer. 132 characters per line with cassette type ribbon. 2K buffer and opt tractor feed. Available in serial and parallel... **718.00**

EPROM & RAM SUPER SALE

P/N	Description	8-24	25up
2716	(450nS)	3.95	3.95
2732	(450nS)	4.40	4.40
2532	(450nS)	4.40	4.10
2764	(28 pin)	5.95	5.95
2114L-2	(200nS)	1.62	1.62
4164	(in stock)	Call	Call
6116P-3	(150nS)	6.10	5.75

Mother Boards & Card Cages

SLOTS	Bare Bd	KIT	A & T	w/CAGE
6	\$12.00	\$37.00	\$52.00	\$77.00
8	16.00	48.00	73.00	108.00
12	22.00	68.00	103.00	143.00

10MHz, No termination. Includes power indicator and wiring for muffin fan. Uses OK connector for solderless installation and removal of power & reset lines.



SUNTRONICS CO., INC.
12621 Crenshaw Blvd., Hawthorne, CA 90250

STORE HOURS: MON.-FRI. 9:00am to 6:00pm SATURDAY 10:00am to 5:00pm

Mail Order—Min. Order \$10. Visa or MasterCard (please include expiration date). Add \$2.00 (shipping and handling) for first 3 pounds plus .50 for each additional pound to your order. CA residents add Calif. sales tax.

CIRCLE 78 ON READER SERVICE CARD

Software Directory

Program name: MBasic-to-Oasis Basic translator (MTRANS)

Hardware system: Any computer that can run under OASIS

Minimum memory: 64K in 8-bit; 320K in 16-bit

Language: OASIS Basic and OASIS Exec

Description: MTRANS is a utility that converts Microsoft Basic programs to executable OASIS Basic with little or no programmer assistance. When translated, all programs automatically support OASIS' multiuser functions, including automatic record locking and optional file locking.

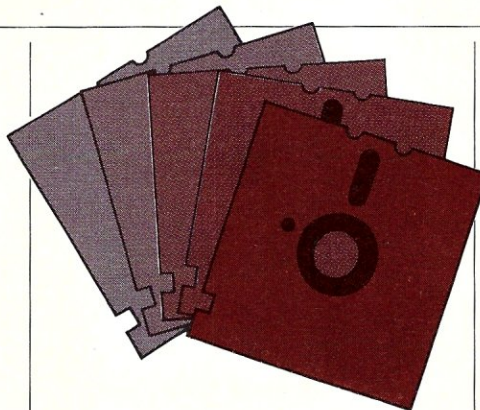
MTRANS converts any MBasic program which has been saved in ASCII format and moved to OASIS via the GETFILE command. It displays each line of program text on the CRT screen as it is being converted, and informs the operator of any difficulty or errors in a brief report which may be written to a sequential file or printed on an attached printer. Errors are also clearly flagged in the code itself.

To accommodate the various versions of MBasic, MTRANS permits the operator to add, change, or delete items in the replacement table. A re-numbering feature converts line numbers during the first pass of conversion, automatically splitting long lines as needed for logical execution. In addition, MTRANS enables the operator to enter the dimensions of the screen used by the original program and then reconfigure the size to accommodate virtually any CRT. Files may be opened with LOCK, FORMAT, and QUOTE options. The operator also may choose which output device will be used to store the MTRANS files.

The key element of MTRANS is a subroutine generator which allows the file-handling logic of Microsoft Basic to be used under OASIS. Generated subroutines include FIELD statements, GETs, and PUTs. MTRANS also creates functions to handle CVI, CVS, CVD, MKIS, and MKD\$, along with PRINT@, RIGHTS, and VAL.

Price: 8-bit version of MTRANS, \$245; 16-bit version (soon to be released), \$345.

Included with price: MTRANS on appropriate disk, documentation, full reference guide, and technical



support from Phase One.

Available from:

Phase One Systems, Inc.

7700 Edgewater Drive, Suite 830

Oakland, CA 94621

(415) 562-8085

CIRCLE 325 ON READER SERVICE CARD

Program name: 8086 OS converter

Hardware system: PC-DOS (MS-DOS), CP/M-86

Language: Object code

Description: The OS converter, produced by Dynamic Microprocessor Associates, permits PC-DOS (MS-DOS) object code to run on CP/M-86 microcomputers, and enables CP/M-86 object code to run on MS-DOS systems. Use of the OS converter involves no loss of speed, and will permit users to run such programs as Microsoft Basic and Fortran, Digital Research Pascal and other language compilers, as well as utilities like Microsoft ASSEMBLER and LINKER.

The new program operates by loading a target program into memory and creating the environment that the program expects. There is no interpretation of instructions; the program itself remains in control of operations.

The OS converter is 4K in size. When in use, it resides just above the operating system in RAM and enables the program being run to take full advantage in available memory. The OS converter for the IBM PC is supplied with a companion program that enables PC-DOS systems to read CP/M-86 files.

When released: May 1983

Price: \$95

Available from:

Dynamic Microprocessor

Associates, Inc.

545 Fifth Ave.

New York, NY 10017

(212) 687-7115

CIRCLE 328 ON READER SERVICE CARD

Program name: Database System

Hardware system: CP/M Plus

Minimum memory: 241K

Language: CB-80

Description: Tarbell Electronics has introduced an improved Database System for CP/M Plus. This system's added functions include multiline field type, multilevel sort, nested IF-ELSE, and user-creatable menus. DBQUERY now has features that were previously available only in the DBREPORT module. ATTACH and DETACH commands for MP/M printers are new, and it is now possible for several users to append data to the same file, with all data intact.

Nested IF-ELSE-ENDIF for command files are now part of DBQUERY and DBREPORT. New functions in both are upper case, ASCII character, length and index.

The entire system is more user-friendly. In the new Tarbell Database System CP-80, overlays are now used instead of .COM files for modules. This saves disk space, improves loading time, and allows sharing of common variables between modules.

Price: Complete system in ready-to-run form, \$100; source code in CB-80, \$200. Updates: \$25 for database system only; \$50 including source code.

Available from:

Tarbell Electronics

950 Dovlen Place, Suite B

Carson, CA 90746

(213) 538-4251

CIRCLE 329 ON READER SERVICE CARD

Program names: TRAKSPAYER and TUNINGS

Hardware system: Soundchaser computer music system, Apple II+, Apple IIe, Franklin Ace 1000

Minimum memory: 48K

Description: Passport Designs, Inc. has added two new utility software packages to its software list. TRAKSPAYER and TUNINGS allow Soundchaser users to greatly expand their musical imagination and enjoyment. TRAKSPAYER is a "record player" program for four-track composition. It allows the user to produce albums by creating four-track musical selections. They may

SOURCE CODE

Dynamic Z80 Full Screen Debugger \$30.00
Includes SOURCE CODE, Dynamic full screen update of all registers and specified memory block, you can Single Step, Modify, Set Breakpoints, Disassemble, Display Memory, Use symbols. Too many other features to list here.

Modem Finder - Z80B - Z80 \$30.00
Includes SOURCE CODE, Allows you to specify up to 10 phone prefixes and the starting and ending suffix for each. It will log all numbers with modems on the other end to disk. For Hayes Smartmodems or compatible modem.

Setcom-Zilog SIO Configuration Program \$30.00
Includes SOURCE CODE, Allows setting: Baud Rate, Number bits per word, Stop bits, Parity, Request To Send, Data Terminal Ready, Auto-Enables for automatic hardware handshaking and CP/M's IOBYTE. Baud Rate may be set from 1 - 65535 baud if a CTC chip is used to generate the baud rate.

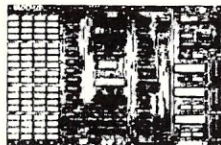
All orders shipped on 8 in. single density disk unless prior arrangements are made. All prices plus shipping. All orders shipped C.O.D. unless prior arrangements are made. All orders shipped from stock.

Steele & Associates
3328 Fall Creek Dr.
Nashville, TN 37214
615/889-6636

8080 Trademark of Intel Corp.
Z80, SIO, CTC, Trademarks of Zilog Corp.
CP/M Trademark of Digital Research, Inc.

CIRCLE 60 ON READER SERVICE CARD

The Mega Super Computer



Free Computer with a Purchase of a RAM Disk

* Z80B Running at 5mhz, * Versatile CPM, * Math chip 9511 or 9512 AMD, * 48 Plus Ports on Mega Expander BUS, * CTC, DMA, * 2 Parallel Ports—with hand shaking, * Serial Ports—with or without hand shaking runs 150 to 19K2 Baud. Runs most terminals, printers, and modems.

* NOW! CPM 3.0

* Hard Disk Interface hooks directly to Priam Drives.
* Floppy Disk Controller—Handles Single Density IBM compatible disks and Dual Density 1 or 2 sided supports. 8" or 5 1/4" in various combinations—3 Drives equal over 4 Mega Bytes of Storage. WD2797

* 512K Bytes of 64K D-rms, with parity configurable as a HIGH SPEED ELECTRONIC DISK or 8 banks of 64K for multi-user or countless other applications.

* All this on a state-of-the-art 4 layer card—with accurate documentation—10" x 15".

* Prices: Bare Board with Documentation \$399
64K Base System A & T \$495
512K Base System A & T \$1595
CPM 2.2 System A & T \$125
512K Base Kit \$1299
Manual \$25
MPM \$325

MEGA CO.

2318 S. Park Street, Madison, WI 53713 (608) 255-7400

CIRCLE 47 ON READER SERVICE CARD

CP/M.D.

Diagnose and cure disk problems quickly and easily. Recover erased files, retrieve "bad sector" files, lock out bad sectors. CP/M.D. is a "doall" CP/M utility with dozens of menu-driven fast-acting functions. Requires 2 drives, 32K, CP/M 1 or 2.

SIMPLE-SIMON
SOFTWARE

\$29.95

Add \$2.25 per order for shipping. Send check for prompt shipment. Ga. residents add 4% sales tax. Specify CP/M 8", Superbrain, or Xerox 5.25". CP/M is a trademark of Digital Research, Inc.

Write for information about CP/M database system, \$89.95; word processing, \$88.90; other inexpensive CP/M software.

TELEPRINT, INC.

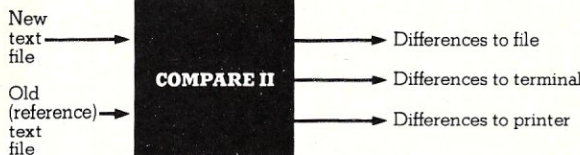
PO Box 10B, Sylvania, Ga. 30467

CIRCLE 271 ON READER SERVICE CARD

No more lost edit changes!

COMPARE II

High performance differential text analyzer!



Writers! Researchers! Lawyers! Engineers! Programmers!
Use highly rated COMPARE II. Cut text analysis from hours to minutes!

- ▶ PC-DOS, CP/M-86 or CP/M 2.2
- ▶ Scans by word or by line
- ▶ Fast New Algorithm, No file restrictions
- ▶ You can customize for word processor, printer width, file defaults, specific work flow, computer languages, different highlighting techniques
- ▶ Clear commands, Numerous formatting options
- ▶ Can generate new document with change bars

Specify When Ordering: Operating System, Computer Type and Disk Format. Free brochure and nearly free demo disk available.

COMPARE II

Demo Disk (credits to purchase).....

\$145.00

\$12.95

SOLUTION TECHNOLOGY, INC.

"We Deliver Productivity"

1499 Palmetto Park Road
Suite 218
Boca Raton, FL 33432
305/368-6228

PC-DOS and CP/M are trademarks of IBM and Digital Research respectively.

Check or COD, Florida residents add 5% sales tax. Dealer and Distributor inquiries welcome.

CIRCLE 50 ON READER SERVICE CARD

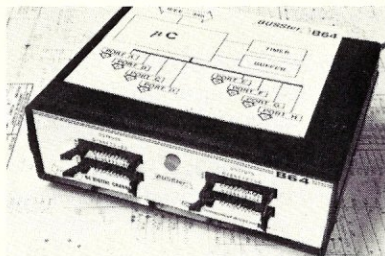


COMPUTER INTERFACES

IEEE — 488
RS — 232

ANALOG AND DIGITAL INPUT/OUTPUT MODULES

The BUSSter line of analog and digital products was designed to collect data and to output signals to laboratory and industrial equipment in conjunction with a microcomputer system. These powerful self-contained modules reduce a computer's workload by providing read or write operations to external devices. They are controlled as slave interfaces to real-world physical applications. Control is over an IEEE-488 (GPIB) bus or RS-232 port. BUSSter modules are available in several digital and analog configurations. The internal buffer and timer provide flexibility by allowing the BUSSter to collect data while the host computer is busy with other tasks.



BUSSter A64—64 channel digital input module to read 64 digital signals. Built-in buffer **\$495.00**

BUSSter B64—64 channel digital output module to send 64 digital signals **\$495.00**

BUSSter C64—64 channel digital input/output module to read 32 and write 32 digital signals. Built-in buffer **\$495.00**

BUSSter D16—16 channel analog input module to read up to 16 analog signals with 8 bit resolution (1/4%) Built-in buffer **\$495.00**

BUSSter D32—32 channel version of the D16 **\$595.00**

BUSSter E4—4 channel analog output module to send 4 analog signals with 12 bit resolution (.06%) **\$495.00**

BUSSter E8—8 channel version of the E4 **\$595.00**

BUSSter E16—16 channel version of the E4 **\$695.00**
Add the suffix -G for IEEE-488 (GPIB) or -R for RS-232.

All prices are USA only. Prices and specifications subject to change without notice.

30 DAY TRIAL—

Purchase a BUSSter product, use it, and if you are not completely satisfied, return it within 30 days and receive a full refund.

US Dollars Quoted
\$10.00 Shipping & Handling
MASTERCARD/VISA



Connecticut microComputer, Inc.
INSTRUMENT DIVISION

36 Del Mar Drive
Brookfield, Ct. 06804
(203) 775-4595 TWX: 710-456-0052

CIRCLE 18 ON READER SERVICE CARD

1984 Business Activity Planner

Imagine! A complete Appointment Book, Financial Record Keeping System, Travel Information Guide, Health and Fitness Aid and Directory... All in one book!

No matter how organized and successful you are today, our Planner will make you even better in the future... or your money back!

**IT'S A
GREAT
GIFT
IDEA,
TOO!**

IT'S AN APPOINTMENT BOOK! SEE-A-WEEK CALENDAR

■ A full week... at a glance! Time planning becomes easy when your appointments, meetings, luncheon and dinner engagements and special activities are in front of you.

HALF-HOUR TIME SCHEDULING

■ Convenient scheduling... seven days a week.

THINGS TO DO TODAY

■ Keep track of important follow-ups, telephone calls and correspondence.

SEVEN SNAP-LOCK RINGS

■ The seven ring format insures that your pages won't pull out... unless you want them to!

BEAUTIFUL, SOFT, LEATHER-LIKE BINDER

■ Padded front and back, your 9½ x 11½ Planner is comfortable to carry. You can take it with you wherever you go. The sturdy, permanent bookmark always keeps you in the right week and the two inside pockets enable you to keep all your important papers in your **1984 Activity Planner**.

YOUR CHOICE OF IMPRINTS

■ Order the 1984 Business Activity Planner for everyone in your office... and select the cover imprint for

each person! Available with Business Activity Planner, Chairman of the Board Activity Planner, Executive Woman Activity Planner, or Executive Activity Planner.

IT'S MUCH MORE!

■ Each Section is Index-Tabbed for Instant Retrieval of Information.

FINANCIAL RECORD KEEPER

- 12 Income and Expense Reports
- 1984 Business Tax Calendar
- Executive Compensation Checklist
- Personal Investment Portfolio

HEALTH AND FITNESS AID

- Fat - Cholesterol - Calorie Charts
- Value of Various Exercises

- Substitution Chart for Better Health
- First Aid Tips

TRAVEL INFORMATION

- Average Temperatures for Most Major Cities
- Rank and Population of the Top 100 U.S. Cities
- Traveling Distances
- Toll-Free Telephone Numbers for Major Airlines, Auto Rentals, Hotels, Motels and much more!

MISCELLANEOUS

This section is filled with valuable information including Principal Holidays, French and California Wine Vintage Charts and more.

DIRECTORY

Places all emergency and important telephone numbers at your fingertips.

ZIFF-DAVIS ACTIVITY PLANNER P.O. Box 16-2354, Miami, FL 33116
Please send me the following 1984 Activity Planners at \$38.95* each plus \$5 per copy postage and handling. Outside U.S.A. add \$10 per copy postage and handling.

Specify quantity for each cover imprint ordered:

- ___ Business Activity Planner(s)
- ___ Chairman of the Board Activity Planner(s)
- ___ Executive Woman Activity Planner(s)
- ___ Executive Activity Planner(s)

QUANTITY DISCOUNTS

(on total number of Planners)

6-20	10% off	(\$4 P&H each)
21-50	15% off	(\$3 P&H each)
51-or more	20% off	(\$2 P&H each)

☐ Payment enclosed. ☐ American Express ☐ Visa ☐ MasterCard ☐ Purchase Order enclosed.

Card No. _____ Exp. Date _____

Signature _____

Name _____ (please print)

Company _____

Address _____

City/State/Zip _____

*Florida residents add 5% sales tax.

SATISFACTION GUARANTEED or return

MS11 within 10 days for a prompt refund!

FOR FASTER SERVICE CALL TOLL FREE

800-327-1969

(In Fla. and Canada call (305) 595-8744.)

NOVEMBER SPECIALS: HUGE DISCOUNTS DEALER PRICING OFFERED TO THE GENERAL PUBLIC

GODBOUNT COMPUPRO: BOARDS AND SOFTWARE

30% OFF LIST FOR ORDERS OVER \$1,000
34% OFF LIST FOR ORDERS OVER \$5,000

Examples:

8085/8088 CPU ASM 34% OFF = \$327
RAM 17 ASM 34% OFF = \$329

GODBOUNT SYSTEMS:

816A ASM \$4,029	816A CSC: \$4,387
816B ASM \$4,730	816B CSC: \$5,174
816C ASM \$6,074	816C CSC: \$6,626

U.S. ROBOTICS MODEMS: (Even lower pricing for quantity orders!)

AUTODIAL 212A \$485	1200/300 AUTO ORIG/ANS
PASSWORD \$368	1200/300 AUTO ORIG/ANS
TELPAC \$ 75	COMMUNICATIONS SOFTWARE
AUTOLINK 1200 \$389	1200 BAUD

HAZELTINE ESPRIT TERMINALS: quantity one to five:

Serviced nationally by TRW

ESPRIT I:	\$480	
ESPRIT II:	\$530	- detached keyboard
ESPRIT III:	\$630	- detached keyboard and all features of Televideo 950

SCION MicroAngelo S-100 Graphic boards:

MA512 PAK I:	\$636
MA512 PAK II:	\$716
MA520 PAK II:	\$876
MA520 SW +:	\$1,152

SEMDISK DISK EMULATION RAM: S-100, TRS-80

512K: \$1,152
1 MB: \$1,810

NEC APC 8086 DUAL 8" DRIVES, 128K RAM: \$2,793

COLOR SYSTEM, WINCHESTER OTHER OPTIONS
19% OFF LIST

HOUSTON INSTRUMENTS PLOTTERS:

DMP 29: \$1,838
DMP 40: \$ 762
DMP 41: \$2,397
DT 11 Digitizer: \$694

3M SCOTCH DISKETTES: (MINIMUM 5 BOX ORDER)

8" SS/SD: \$25 8" SS/DD: \$31.25 8" DS/DD: \$40
5" SS/DD \$23.75 5" DS/DD: \$33.75

OTHER EXCELLENT BUYS: (minimum \$1,000 order)

LOMAS 8086 BOARDS AND SYSTEMS: 20% OFF LIST
CROMEMCO: SYSTEMS AND SOFTWARE: 25% OFF LIST

BOARDS: 15% OFF LIST

IMS INTERNATIONAL SYSTEMS AND BOARDS: 28% OFF LIST
CORVUS WINCHESTER SYSTEMS: 18% OFF LIST
INTERCONTINENTAL MICRO: 25% OFF LIST
TARBELL SYSTEMS AND BOARDS: 25% OFF LIST

LOW PRICES ON PRINTERS:

EPSON, NEC AND TI PRINTERS

Prices subject to change without notice.
PROMPT AND COURTEOUS SERVICE
IS OUR HALLMARK!

WE EXPORT: TWX 710 588 2844
ANSBACK: OWENSASSOC.

JOHN D. OWENS ASSOCIATES

12 SCHUBERT STREET
STATEN ISLAND, NEW YORK 10305
(212) 448 6298 (212) 448 6283 (212) 448 2913

Software Directory continued . . .

then be played back in any order and repeated as many times as desired. Simply by loading the tracks into TRAKSPLAYER and organizing the playback, an album is produced. This utility also takes advantage of improved DOS and compressed file formats.

TUNINGS, the second package, is a collection of different four-track tuning files for the Soundchaser keyboard. This allows the user to experiment with a variety of tunings for exotic instruments such as

eastern or ancient instruments. Included in the package are "Mean," "Just," "Tempered" and "Quarter" tone tunings. Several unusual tunings are also included to stimulate the user's creativity. Price: TRAKSPLAYER: \$75; TUNINGS: \$50

Included with price: disk and instructions.

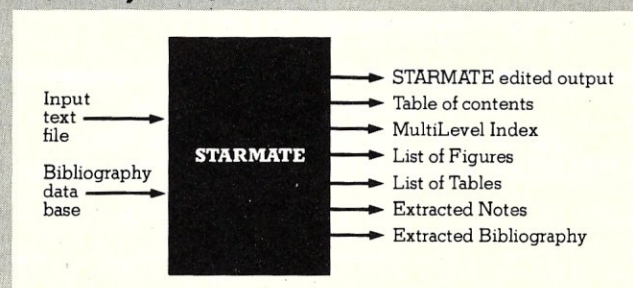
Available from:

Passport Designs, Inc.
116 North Cabrillo Hwy.
Half Moon Bay, CA 94019

Get more than WordIndex for less \$!

STARMATE

Users get high speed document finishing for WordStar with STARMATE under PC-DOS, CP/M-86, or CP/M 2.2.



Writers! Researchers! Engineers! Cut document makeup time from hours to minutes!

- ▶ Multi-Level Table of Contents
- ▶ Multi-Level Index
- ▶ Lists of Tables and Figures
- ▶ Numbers Paragraphs (1.2, 1.3, etc)
- ▶ Prepares Footnotes
- ▶ Prepares Bibliography
- ▶ Clear commands, Numerous formatting options
- ▶ Reads documents with nested files

Specify When Ordering; Operating System, Computer Type and Disk Format. Free brochure and nearly free demo disk available.

STARMATE

(Special Introductory Price)

Demo All Disk (credits to purchase) \$12.95

\$145.00

SOLUTION TECHNOLOGY, INC.

"We Deliver Productivity"

1499 Palmetto Park Road
Suite 218
Boca Raton, FL 33432
305/368-6228

WordStar, PC-DOS and CP/M are trademarks of
MicroPro, IBM and Digital Research respectively.

Check or COD, Florida residents add 5% sales tax.
Dealer and Distributor inquiries welcome.

CIRCLE 16 ON READER SERVICE CARD

Introducing SPL the first multi-mode spooler for CP/M computers

If you believed that your computer couldn't do better than a single task system think again. You can convert your machine into a dual-task computer with **SPL**, the amazing Spooler program developed by Blat R+D. **SPL** enables you to use hidden capacity available on your CP/M computer to print documents and run your ordinary programs, all at once.

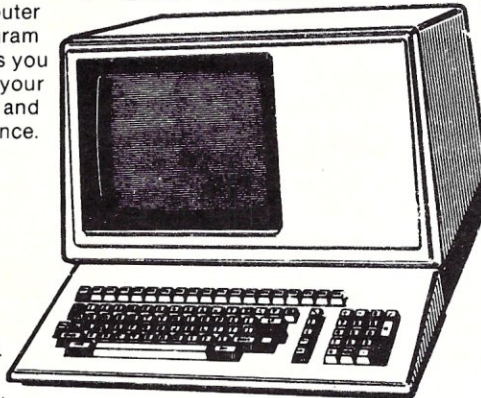
While printing, your regular programs won't stop processing, waiting for the printer to finish. **SPL** will store the information to be printed in internal or external (disk drives) memory until the printer is ready to receive the data. Result: your programs will run at full speed.

As **SPL** can use up to the full capacity of your disks for temporary storage, it's much more powerful than hardware spoolers, which are limited to 64k memory or less.

SPL is an advanced product with several modes of operation. In addition to intercepting the output to the printer, **SPL** can print your existing text files, or those that your programs will create from now on. **SPL** will even take care of tab expansion. As an added bonus, **SPL** needs no installation on most CP/M 2.x computers.

If you have a computer

Get A Second Computer FOR \$139



Registered Trademark of Digital Research

You could get an equivalent increase in computing power by spending \$1000 to \$3000, but **SPL** is only \$ 139, including disk and manual.

To order your **SPL** program call us today specifying what disk format you require. You can charge it to your VISA or Master Card if you prefer.

Blat Research+Development Corp.
8016 188th SW, Edmonds WA 98020
Call toll-free 1-800-LOBO-BAY
in WA call [206] 771-1408

CIRCLE 151 ON READER SERVICE CARD

SAVE YOUR 8BIT SYSTEM JOIN THE 16/32 BIT REVOLUTION THROUGH EVOLUTION, FOR UNDER \$800

HAVE YOU BEEN LOOKING FOR A 16/32 BIT SYSTEM WHICH DOES NOT OBSOLETE YOUR CURRENT Z80 HARDWARE OR SOFTWARE?

WOULD YOU LIKE TO RUN CPM86™, CPM68K™, MS-DOS™, OR UNIX™ ON YOUR Z80 SYSTEM?

WOULD YOU LIKE TO RUN IBM™ PC APPLICATIONS ON YOUR Z80 SYSTEM?

HAVE YOU BEEN LOOKING FOR A COST EFFECTIVE 16/32 BIT PROCESSOR SOFTWARE DEVELOPMENT SYSTEM?

WOULD YOU LIKE TO OFFER YOUR 16/32 BIT APPLICATIONS FOR USE ON Z80 BASED SYSTEMS?

WOULD YOU LIKE TO ADD AN INTELLIGENT HIGH SPEED RAM DISK TO YOUR Z80 BASED SYSTEM?

WOULD YOU LIKE TO MARKET YOUR Z80 SYSTEM AS AN 8/16 BIT SYSTEM?

IF YOU ANSWERED YES TO ANY OF THE ABOVE YOU SHOULD CONSIDER THE HSC C016 ATTACHED RESOURCE PROCESSOR.

C016 WITH EITHER 80186 OR 68000 MICRO PROCESSOR AND UP TO 768K BYTES OF RANDOM ACCESS PARITY CHECK MEMORY MAY BE ATTACHED TO VIRTUALLY ANY Z80 BASED SYSTEM. C016 IS HOUSED IN AN ATTRACTIVE DESK TOP CASE WHICH CONTAINS THE 16 BIT PROCESSOR, MEMORY, AND POWER SUPPLY. C016 IS DELIVERED WITH A COMPLETE SET OF DEVELOPMENT TOOLS AND THE MINIX OPERATING SYSTEM. CPM86 AND CPM68K ARE AVAILABLE AS OPTIONS.

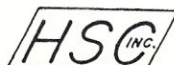
PRICES START AT \$660 FOR C016 WITH 128K OF MEMORY, PRICE INCLUDES SOFTWARE AND DOCUMENTATION

HSC ALSO HAS COMPLETE CPM80 CROSS DEVELOPMENT SYSTEMS FOR DEVELOPING 68000, 8086/8088, 80186, AND 80286 SOFTWARE WHICH MAY BE PURCHASED SEPARATELY.

DEALER, DISTRIBUTOR, AND OEM DISCOUNTS ARE AVAILABLE

FOR INFORMATION CONTACT:

HSC INC.
BOX 86
HERKIMER, NEW YORK 13350
PHONE (315) 866 - 2311



CIRCLE 45 ON READER SERVICE CARD

NEW! NEW! NEW!
SPOOL-Z-Q 100

256K S-100 PRINTER BUFFER

Now there is a high quality S-100 printer buffer that can free your system from time wasted waiting for your printer to finish. Spool-Z-Q 100 is an S-100 board which has an on-board computer and hardware features which allow it to send to either a serial (RS-232) or parallel (Centronics standard) printer. Spool-Z-Q 100 is available with 32K to 256K characters memory installed. Automatic internal space compression will allow even more storage for reports or listings containing "white space."

TECHNICAL DETAILS —

SERIAL OUTPUT — RS-232 compatible. Baud rates—Switch selectable 19.2K, 9600, 4800, 2400, 1200, 600, 300 & 150 baud.

PROTOCOLS — Switch selectable XON/XOFF, ETX-/ACK, ENQ/ACK, Reverse Channel (Busy/Ready) either polarity, or parallel.

PARALLEL OUTPUT — Standard Centronics interface signals, 8 Data, Busy & Strobe.

S-100 (IEEE 696) INTERFACE — No wait states required on any system. Switch selectable I/O address can be set to ANY one of the 256 possible addresses. Extremely simple to use. Simply monitor the Busy status bit and send data to Spool-Z-Q when not busy. All protocols, etc. are taken care of already.

MEMORY TYPE AND EXPANSION — Spool-Z-Q 100 uses industry standard 4164 type 64K RAM chips. Sizes available are 32, 64, 128, 192, and 256K characters. Every Spool-Z-Q 100 is fully socketed for 256K and may be expanded by just plugging in chips.

AUTOMATIC SPACE CHARACTER COMPRESSION — Although the maximum size is 256K (60-120 pages of print) the space compression feature allows Spool-Z-Q to effectively hold much more printing which contains many spaces (listings, reports, etc.). A 256K Spool-Z-Q 100 can hold about 8 million spaces (about 2000 pages worth).

OTHER CAPABILITIES — Spool-Z-Q 100 has the same Pause-on-Formfeed, Clear Buffer, Copy, and Self-Test abilities as our stand-alone Spool-Z-Q. Signals are available on an 8 pin DIP socket to allow control of these functions via a simple external switch panel which will be available as an option.

Everything we sell comes with a 15 day trial period, and Spool-Z-Q 100 is no exception. Try it out in your system. If it isn't exactly what you need, send it back. Your money will be refunded immediately.

PRICES: (including shipping)

32K - \$319	64K - \$349
128K - \$409	192K - \$469
256K - \$529	

Calif. Res. Add 6% tax.

We accept MC, VISA, AMEX and COD orders. No extra charge for COD.

JVB ELECTRONICS

1601 Fulton Ave., Suite 10A
Sacramento, CA 95825
Phone: (916) 483-0709

Other products available from JVB Electronics are SPOOL-Z-Q parallel stand alone buffers, and the FDCX4 Double Density Upgrade Board for Cromemco's 4FDC.

DEALERS WANTED!

CIRCLE 28 ON READER SERVICE CARD

Software Directory

continued . . .

(415) 726-0280

CIRCLE 330 ON READER SERVICE CARD

Program name: WS-Patch

Hardware system: CP/M 8" SSSD, 5 1/4" Osborne, Kaypro, Morrow, North Star, Epson QX-10, Apple (CP/M) card. MS DOS 5 1/4" IBM PC and compatibles.

Language: Machine Code

Minimum memory: 64K

Description: Enhancement program for WordStar enables the user to access all of his dot matrix printer's capabilities through WordStar. WS-Patch also revises WordStar's print menu to include the new printing commands. Depending on the type of printer, WS-Patch may enable wide and condensed type, letter quality printing, continuous underline, sub and superscript, italics font elite, doublestrike, triplestrike, proportional spacing and various combinations. Programs available for Epson and Epson-compatible printers, Okidata microline printers and CITON prowriter printers. WS-Patch documentation comes on the

TALISMAN T.M.

It's almost magic!

**CP/M® Terminal Translation
& Multiple Keyboard Redefinition Program**

- ★ Emulates ANY interactive terminal — runs ANY CP/M 2.2 software on your microcomputer.
 - ★ Bridges between your micro and mini or mainframe terminals.
 - ★ Redefines any key(s) to produce up to 249 characters.
 - ★ Creates, saves, edits, and retrieves up to 255 keyboard overlays.
 - ★ Reprograms *on-the-fly*, while you're running another program.
 - ★ And so much more!
 - ★ A godsend for programming, data entry, word-processing.
 - ★ Transparent to the user. No wiring or soldering.
- User-friendly. Best documentation in the industry.

TALISMAN™ is only \$125, manual included.

California residents add 6% sales tax.

Call or write for free details.

**disco
tech**

DISCO-TECH®

a division of Morton Technologies, Inc.

600 B St. / P.O. Box 1659

Santa Rosa, CA 95402

Tel. 707 / 523-1600

Dealer inquiries invited.

CIRCLE 23 ON READER SERVICE CARD

TECHTYPE

You need to write no-русски? עברית? ¿En español?
Or worse yet --

$$P_{nm}(\cos \theta) = \frac{\sin^m \theta}{2^n n!} \frac{d^{n+m}}{d\eta^{n+m}} (\eta^2 - 1)^n ?$$

Your present word processing system isn't exactly a polyglot and flunks algebra? What's the solution?

TECHTYPE™ is a text-formatting system designed especially for *scientific, engineering, mathematical, and multi-lingual* document preparation. TECHTYPE runs under CP/M® and is adaptable to most hardware. By using your present editor and its three programs

- DISPLAY - Preview on CRT screen
- DRAFT - High-speed dot-matrix printout
- PRINT - High-quality daisywheel printout

you can spend more of your time *solving* equations instead of typing them.

TECHTYPE's capabilities include:

- Multiple type fonts
- Multipass printing
- Unlimited sub/superscript levels
- Control of format, font, pitch, and emphasis.

Multipass printing allows the use of up to *ten* different fonts with only *one* printwheel change per page per font. Price \$300.

**GREEN MOUNTAIN RADIO
RESEARCH COMPANY**

240 Staniford Road

Burlington, Vermont 05401 U.S.A.

802-862-0997

POWER & PRICE

**Introducing the KEY DP220
from Key Micro Systems**

A complete 4-user (expandable to 8-user) system with dual processor, dual half-height 8" drives and 20 Mbytes. With it you can enjoy the best of an S-100 computer and run any mix of 8 and 16 bit programs simultaneously. Our use of the highest quality peripherals combined with the power of CompuPro boards delivers the reliability you need — at the right price.

For established systems, peripheral support, or custom configurations, we deliver the power you want at a powerfully affordable price.

**Key Micro Systems, Inc. is a
Full Service CompuPro®
Systems Center**

KEY
MICRO SYSTEMS INC.

Terminals optional.

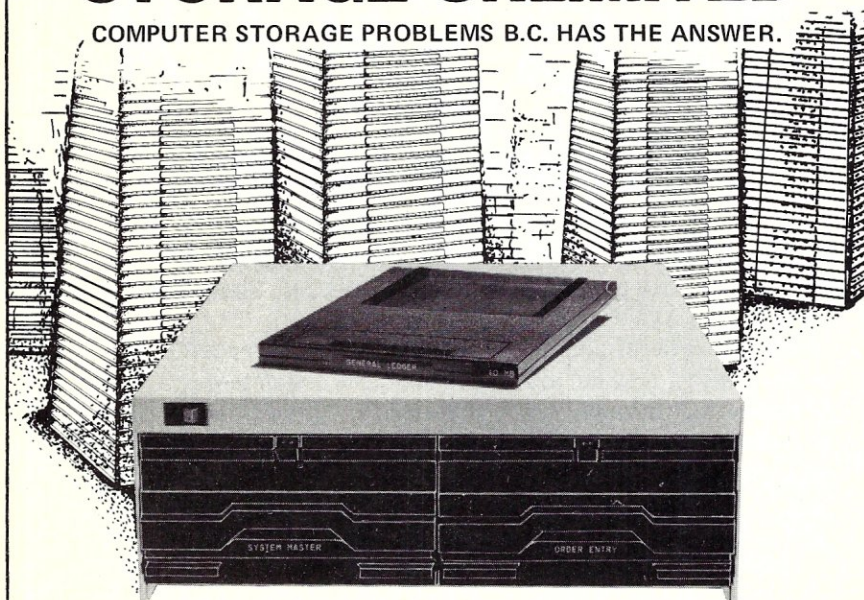
1606 Nooseneck Hill Rd., PO Box 715, Coventry, RI 02816 • 401/828-7270
822 Boylston St., Suite 201, Chestnut Hill, MA 02167 • 617/738-7305

CIRCLE 240 ON READER SERVICE CARD

CIRCLE 40 ON READER SERVICE CARD

STORAGE UNLIMITED

COMPUTER STORAGE PROBLEMS B.C. HAS THE ANSWER.



BC-20 is the 20 megabyte solution to disk storage problems. The removable storage disk system that now makes unlimited storage available, reasonable and takes virtually no space.

BC SYSTEMS INC. 1016 East 31st. Street
LaGrange Park, Illinois. 60525 (312) 579-0672

CIRCLE 1 ON READER SERVICE CARD

CompuPro[®]

SYSTEMS

SYSTEM A..... \$4260.
SYSTEM B..... \$5150.
SYSTEM C..... \$6660.

These systems are configured, assembled and tested before being delivered to you.
We are a **full service** computer dealer since 1975.

All CompuPro & Morrow boards are available at significant discounts. Call for latest prices.

☆ **WITH THE PURCHASE OF ANY SYSTEM, YOU MAY PURCHASE UP TO \$5000 OF SOFTWARE AT THE WHOLESALE COST. SAVE NOW!** ☆

● NATIONAL USER'S GROUP FORMING ●

- Share technical information
- Receive list of other area users
- Bulletin board & RCPM planned.

Send name, address, system info to:

CPRO USER'S GROUP P.O. BOX 1474 WOODBRIDGE, VA 22193
(optional: \$10 Charter Membership — thanks.)

ONETCO
OFFICE NETWORKS CORPORATION
Northern Virginia
(703) 690-3312

CIRCLE 68 ON READER SERVICE CARD

Software Directory

continued . . .

program disk. The documents print out of the user's printer. The file, which is a standard WordStar file, can be edited to see how the print commands are entered in the file and how they will print out.

When released: February, 1983

Price: \$49.95

Included with price: appropriate disk, instructions, document file. IBM version includes WS-KEYS, a utility program that allows the user to redefine the IBM function keys in WordStar.

Available from:

CMB3

P.O. Box 3061

Walnut Creek, CA 94598

(415) 372-7733

CIRCLE 332 ON READER SERVICE CARD

Program name: Model EIS-110

Hardware system: 8086, 68000, Z-8000 class machines; any 16-bit or larger computer; any microcomputer

Minimum memory: 32K with application software

Language: C

Description: This versatile micro-processor-based, real-time operating system incorporates a number of unusual features designed to overcome man-machine interface problems. Among the numerous advantages of EIS-110 are: menu-driven command scanning that eliminates operator uncertainty; structured program commands that speed and simplify program writing and maintenance and minimize bugs; prioritized, responsive queue scanning for real-time capabilities; built-in data-reduction algorithms for conservation of memory while collecting data. The method of dispatching employed by EIS-110 is economical for analyzing a relatively small number of tasks and responding on a priority basis. Commands are prioritized, allowing high-priority commands, such as diagnostics, to be invoked while the machine is operating on a previously issued command. EIS-110, which uses COHERENT, a UNIX-compatible operating system, was used to drive a gas spectroscopy in its initial application.

Available from:

Electronic Information Systems

360 Fairfield Ave.

Stamford, CT 06902

(203) 358-0764

CIRCLE 334 ON READER SERVICE CARD

FREE LANGUAGE

NOW YOU CAN GET THE COMPLETE PROGRAMMING LANGUAGE OF YOUR CHOICE:

☐ MULTI-BASIC

☐ PASCAL

☐ C

ABSOLUTELY FREE!

WHEN YOU BUY THE FEATURE PACKED BLAISE II TEXT EDITOR.

What Is Blaise II?

Blaise II is simply one of the most powerful, yet easy to use, full screen text editors available for the CP/M operating system. You can customize it to your particular terminal, taking advantage of all its smart features. You can design your own keyboard layout, utilizing the cursor keys and special function keys. You can create your own powerful commands for performing complex operations with a single keystroke. You can edit more than one file at a time with windowing. You can even create multiple editor configurations, each customized for a particular type of editing. Blaise II has these extraordinary features plus a long list of commands, including block movement of text, fill and justify, string search and replacement, etc. The list goes on and on.

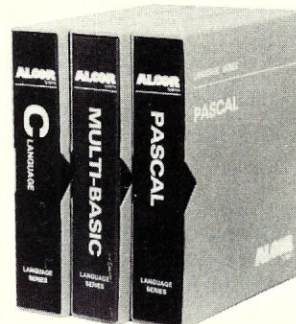
Who Is Making This Incredible Offer?

We are Alcor Systems, the language company. We have created a set of professional quality programming languages and we're giving them away. That's right. Each language comes complete with the powerful Blaise II text editor, easily worth the cost by itself. So in effect, the language is free. Now no one can beat a deal like that. So if you've been searching for the best in text editing and programming, all at an affordable price, your search is over. Just send us the coupon.

- ☐ Please send more information:
- ☐ Blaise II ☐ Multi-Basic ☐ Pascal ☐ C
- ☐ I am enclosing \$250 for Blaise II. Please include the following language at no extra charge.
- ☐ Multi-Basic ☐ Pascal ☐ C
- ☐ Master Charge/Visa # _____
- ☐ Check or Money Order
- I use the following CP/M-80 format:
- | | |
|---------------------------------------|--------------------------------------|
| <input type="checkbox"/> 8" SSSD | <input type="checkbox"/> Kaypro 2 |
| <input type="checkbox"/> Osborne I | <input type="checkbox"/> Kaypro 4 |
| <input type="checkbox"/> AppleII/Z-80 | <input type="checkbox"/> Other _____ |

Please add shipping: \$6 USA or \$28 overseas

Blaise II and Multi-Basic are trademarks of Alcor Systems
CP/M is a trademark of Digital Research Inc.



ALCOR
Systems

800 W. Garland Ave. #204
Garland, TX 75040
214/494-1316

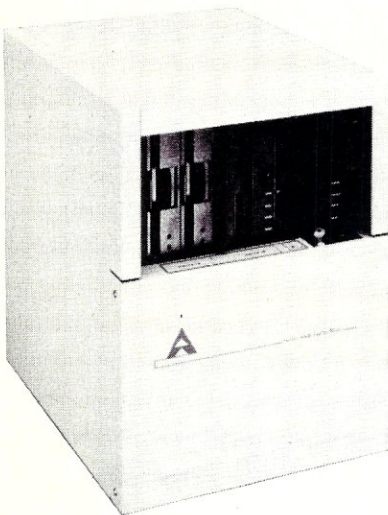
New Products

Series 8000 Turbo-Micro

The Series 8000 Turbo-Micro computer has recently been introduced in a stand-alone model. The Turbo-Micro is designed to provide an expandable, easily-serviced multiuser computer system that maintains industry-standard compatibility with thousands of applications written for the CP/M-80 operating system. It runs under the Turbo-DOS operating system with networking, record locking, password protection, and print spooling capabilities.

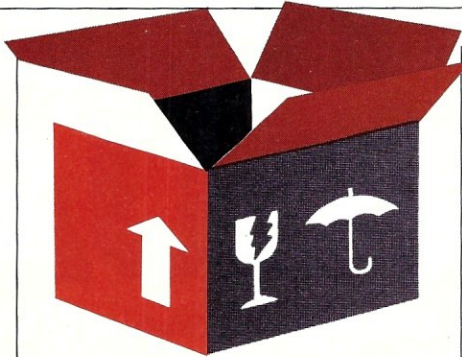
The Turbo-Micro is based on the S-100 bus, with 20 slots for user expansions, and the Z80 8-bit microprocessor. It runs at 6 MHz with 64 or 128K per processor board. It also offers a 16-bit processor board based on the latest Intel chip, the 186 CPU, with 128 or 256K per board.

The Turbo-Micro can support up to 30 independent users, each having his or her own CPU board and own memory, with 300 MB of disk storage using either 5 $\frac{1}{4}$ " or 8" Winchester hard disk. Storage back-up is provided by either a cartridge tape or



1/2" real tape drive. Each Turbo-Micro user controls a dedicated Z80B or 186 processor, 64 or 128K of memory, and four RS-232C I/O ports.

The system master processor board has a Z80B CPU with 128K of memory and two serial, two parallel ports. Its main function is to control the shared resources of floppy and hard-disk storage, floppy controller, DMA interface to hard disk drives,



the real-time clock, and the traffic handling of all other processor boards.

The Turbo-Micro also features self-diagnostics and well-written technical manuals with schematics that make possible a mean time to repair of five minutes. Its modular design allows unskilled persons to replace components and disks by using a simple screwdriver.

The Turbo-Micro's 700-watt power supply is designed for system expansion. It has a constant-voltage transformer that eliminates line voltage fluctuation problems, separate line spike suppression, and a power sequencer for start-up and shut-down to protect electronic components. The power supply is protected by a double-pole circuit breaker and has two convenient AC outlets separately fused.

The system can be moved easily from one location to another, as it has caster rollers. Height: 26 $\frac{1}{2}$ ", width: 18 $\frac{1}{2}$ ", depth: 23 $\frac{1}{2}$ "; weight: 135 lbs.

Price: two-user unit, \$11,000.

Advanced Computer Technology, Inc., 5575 Magnatronic Boulevard, Suite D, San Diego, CA 92111; (619) 571-2746.

CIRCLE 335 ON READER SERVICE CARD

ShareNet operating system

The core of every ShareNet, produced by Novell, Inc., is the Network Operating System. This proprietary operating system is designed specifically for the high-performance demand of networking personal computers. The ShareNet Operating System takes a universal file server approach that will support multiple types of personal computers with their various operating systems. ShareNet will function transparently to the local personal computer sys-

tem. The intent of ShareNet is not to change the local operating system, but to be a natural extension to the networking environment.

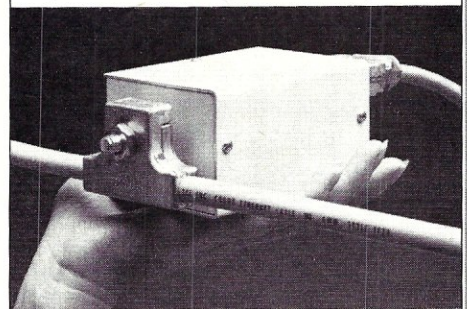
Novell is also offering a Public Bulletin Board and an Electronic Mail Service called HostComm. As new products are added to the Novell product line, they will be available first through this service. The phone number for HostComm is (801) 224-5740; it operates at 300 baud.

Novell, Inc., 1170 N. Industrial Park Drive, Orem, UT 84057.

CIRCLE 336 ON READER SERVICE CARD

New Ethernet transceiver

TCL Inc. has developed an improved, easier-to-install Ethernet transceiver that features two new functions. The new transceiver, called the Model 2010EB, has both heartbeat and watchdog timer features. With the heartbeat circuitry, the transceiver informs the station connected to it that the collision detection circuitry is operational. The watchdog timer circuitry limits the amount of data that can be sent out in a particular packet by cutting off the signal after a specified amount of time, usually



about 60 ms. Like other TCL transceivers, the new unit is designed to operate at a data rate of 10 megabaud.

A number of other features have also been added to the transceiver. First, instead of a fixed-pin stinger, the Model 2010EB features a spring-action stinger that is self-adjusting and maintains the right amount of contact with the center conductor of the cable. Second, the footprint of the transceiver's tap block around the cable has been increased to 2.2". This lessens the chances of losing contact between the stinger and the cable. Third, nonskid ribs have been added on each end of the tap block

ARE YOU DROWNING IN A SEA OF SOLUTIONS?

Recognize the symptoms?

Applications backlog? Technology blur?

Mounting user pressures?

You suspect that suppliers may have answers to your pressing problems, but you don't have enough time to sort through fragmented information to determine what will really work for you.

Like the shoemaker's kid who goes barefoot, you (of all people) need a system. An information system that displays all your current software, hardware and communications options for instant reference.

That system is DATA SOURCES, and you're invited to make it work for you. Simply fill in the coupon and we'll send you DATA SOURCES at 50% off its regular cover price.

What DATA SOURCES does is organize your options. It guarantees that you've considered all relevant products. And makes the most of your time for product evaluations by guiding you to those with the best possibility of success.

DATA SOURCES is a conveniently sized, extremely well-organized and skillfully indexed reference...maintained on a database, constantly updated and published quarterly.

YOU GET...

Hardware—Over 12,000 products from Micros to Mainframes including peripherals—terminals, printers, memory devices, etc...organized by systems compatibility.

Software—The largest available inventory of business packages for micros, minis, and mainframes including operating systems, utilities, and application packages.

Communications Equipment—from modems and multiplexors to local networks, carriers and services. Quick reference comparison charts, plus all diagnostic and test equipment.

Services, Suppliers, Support—Most complete organized listing of suppliers from installation design to maintenance and data center operations.

READ WHAT USERS SAY...

"...Current and comprehensive listings are becoming indispensable."

Gary Yost
Marketing Services Director
ASK Computer Systems, Inc.

"Literally use it daily...dramatically shortens research time...provides more alternatives than would have been known or considered."

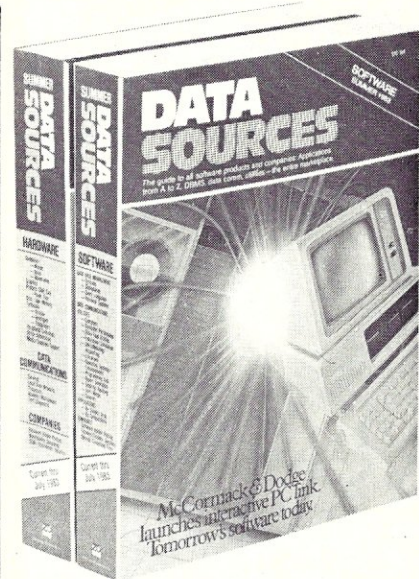
Curt Flatness, V.P.
Logic, Inc.

"Answer to a Systems Integrator's prayer...very effective for locating the equipment we need...using it for everything from single-user systems to systems interfacing with mainframes."

Richard Fletcher, President
Micro Computer Adaptation Procedure

"Dependable source of information otherwise unobtainable or costly to obtain..."

Barry Kukes, President
RSI Repair Service, Inc.



NEW FEATURES...

- ✓ Quick-reference product comparison charts.
- ✓ Market-tracking trends of new DP products.
- ✓ Before-you-buy selection criteria and checklist.
- ✓ Geographical listing of vendors offering on-site and depot maintenance.

ORDER NOW AND SAVE 50%

Yes! Rush me the latest two-volume edition of DATA SOURCES and enter my subscription at \$60.00 for 4 quarterly editions. I save a full 50% off the regular \$120.00 cover price.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone _____

Nature of Company's Business _____

Please check appropriate box: ☐ END USER ☐ VAR/OEM ☐ DISTRIBUTOR

☐ DP MFG ☐ OTHER _____

An information product of Ziff-Davis Publishing Company. Satisfaction guaranteed.

Return coupon to:

DATA SOURCES

P.O. Box 5845, Cherry Hill, N.J. 08034.

Residents of Ca., Co., Ct., D.C., Fl., Il., Ma., Mi., Mo., N.J., N.Y., Vt., please add applicable state taxes.

SAVE TIME...CALL DIRECT

1-800-227-1617 Ext. 251

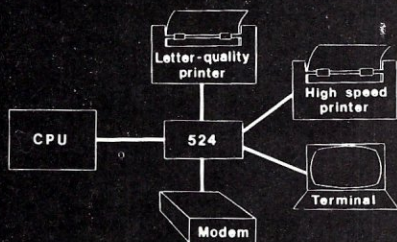
(In Ca., 1-800-772-3545 Ext. 251)

T137

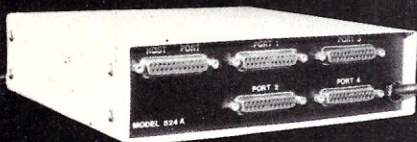
SERIAL PORT EXPANDER AND MORE



BTA's MODEL 524 MULTI-PORT CONTROLLER is a code activated one to four serial port expander — but that's not all since it has separate and independent UARTS, buffers and handshaking each port can operate with a different configuration, i.e. different baud rates, stop bits, etc. These features also permit two or more devices to communicate with the 524 simultaneously.



Full duplex with EIA RS-232 protocol
Baud rates up to 19,200
Expansion to 16 ports by cascading
Peripheral ports may be configured by user software
One year warranty



- **MODEL 524** \$249.00
- **MODEL 524A** \$279.00
 same as model 524 except has 256 byte rx/tx buffers per port
- **MODEL 524 D** \$269.00
 same as model 524, plus continuous polling of each peripheral device for data transfer requests. The device is automatically connected when its 'turn comes up'. ON, BUSY and OFF messages are sent to the peripheral device.
- Other models available — Contact us or your dealer for additional information.

BAY TECHNICAL ASSOCIATES, inc.
 HIGHWAY 603, P.O. BOX 387
 BAY ST. LOUIS, MISSISSIPPI 39520
 (601) 467-8231

CIRCLE 150 ON READER SERVICE CARD

*End the Dark Ages of
Assembly Language....*



with SMAL/80

SMAL/80	Assembler
HL=M (PTR);	LHLD PTR
DE=9;	LXI D,9
HL=HL+DE;	DAD D
IF A=L EQUAL	CMP L
THEN	JNZ L1
A=A-14	SUI 14
ELSE	JMP L2
A=L;	L1:MOV A,L
M(BC)=A;	L2:STAX B

SMAL/80 gives you the logical power, versatility and convenience of a compiled, structured high level language like Pascal, Ada or C, plus the efficiency of assembly language.

- ☐ intuitive, processor-independent symbolic notation system to make your programs easy to read, debug and maintain;
- ☐ programming constructs BEGIN... END, IF...THEN...ELSE, and LOOP... REPEAT, plus indentation, to graphically display the structure of your algorithms;
- ☐ extremely flexible macro and text pre-processor to create your own programming environment;
- ☐ compiler/linker to mix your input source code and relocatable object code, creating modular programs;
- ☐ translator program to automatically upgrade your assembly code to SMAL/80;
- ☐ available on CP/M disks with manual for \$150 plus \$4 shipping.

New! Z-80 version (runs on 8080's): \$175. 8080 version only: \$150. Macro-processor only: \$75. Available on CP/M disks. Add \$4 for shipping. Complete tutorial text: "Structured Microprocessor Programming" (Publ; Yourdon Press) \$20 plus \$2 shipping. Send for your free button and literature or try the Ultimate Demo: SMAL/80 is Guaranteed!

Chromod Associates,
 1030 Park Ave., Hoboken, N. J. 07030
 Telephone: (201) 653-7615

Also available from
WESTICO (203) 853-6880

CIRCLE 9 ON READER SERVICE CARD

BOBCAT

THE FINEST CP/M CATALOGUING SYSTEM YET!

only \$25.00

- creates, adds, updates, and deletes a filename catalog
- provides four report formats and three search routines
- numbers disks and provides titling in catalog
- prints disk contents for disk jacket
- 24 page MICROGUIDE* documentation
- 8" CP/M SSD or Popular 5 1/4"

REQUIREMENTS - CP/M 1.4 and up
 - 56K and up memory
 - two or more drives

U.S. residents \$25.00 U.S.
 Canadian residents \$25.00 Cdn (Ont. residents add \$1.75 pst)
 Other countries \$30.00 U.S.
 plus \$2 P & H

NAME, NUMBER, EXP DATE
 (MC FOUR EXTRA DIGITS)
 Bank drafts; cert. checks; money orders; company checks

R&L Micro Consulting Services

Box 15955, Station F
 Ottawa, Ont.



K2C 358 (613) 225-7904 THE HOME OF THE BOBCAT

*MICROGUIDE is a (tm) or R & L Micro Consult. Sys. CP/M is a (tm) of Digital Research.

CIRCLE 93 ON READER SERVICE CARD

Function Keys—I/O Controller
12K Print Buffer—Clock/Calendar
For \$525.00

THE INTERPRETER.....

A SINGLE BOARD COMPUTER programmed for use as a MENU (programmable function keys) and as a versatile I/O buffer-controller and clock. Other controlling programs downloaded via MONITOR. Used in series with any peripheral (serial protocol, parallel option). Easily labeled keys (via overlay) eliminate the need to memorize control codes or awkward strings. Multistroke commands and repetitive tasks become single stroke functions.

BIG TIME SAVERS
 Word processing
 Data base management
 Non technical users
 Supports any software

STANDARD \$399
DELUXE \$525

DELUXE UNIT FEATURES
 > All std. features
 > 8k Keyset Space
 > 12K PRINT BUFFER
 > Parallel Port
 > Clock/Calendar (Batt. backed)

OPTIONS
 > Engineering Manual
 > Modem
 > Extension Keyboard
 > Bus Interface
 > Custom Overlays
 > Custom Programs
 > OEM designs

2161 Bowen St; Longmont, Co. 80501 (303) 776-2505

CIRCLE 32 ON READER SERVICE CARD

PrintMan Spooler System

The Only Queue Driven Spooler
With Mainframe Power

- Add, Modify, Remove, List Queue Entries
- 255 Simultaneous Entries
- Different Priorities
- Files from Any User Area
- Wildcards "*" and "?" Accepted
- Print Multiple Copies
- Defer Until Time & Date
- Delete After Printing
- Additional Helpful Options

\$195.00

For CP/M-86, Concurrent CP/M-86 and MP/M-86
 (All registered trademarks of Digital Research, Inc.)



Data Base Administrators, Inc.
 W305 S4553 Brookhill Road
 Waukesha, WI 53186
 (414) 968-2583

MasterCard, Visa, American Express

CIRCLE 92 ON READER SERVICE CARD

New Products continued . . .

where it attaches to the cable to further reduce the chances of disconnection when the cable is twisted. Finally, the number of ground pins has been increased from two to four to ensure a solid connection between the tap block and shield.

Dimensions: $2\frac{1}{8}$ " x $2\frac{3}{4}$ " x 4".

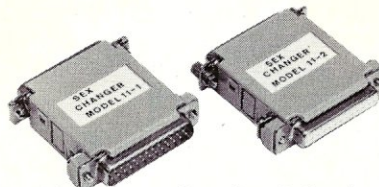
Price: \$232.80, tap block included. Special cable drill, \$11; shield remover tool, \$21.50; insulation piercing tool, \$19.80.

TCL Inc., 2066B Walsh Ave., Santa Clara, CA 95050; (408) 727-3800.
CIRCLE 337 ON READER SERVICE CARD

Sex changer

The Remark Datacom Div. of Telebyte Technology, Inc., has announced the availability of their Series 11 Sex Changer modules to provide a low-cost method of altering the polarity of an existing data cable, terminal, printer or modem. The Model 11-1 is designated male-to-male, whereas the Model 11-2 is female-to-female.

Integrity of the 25 electrical paths of the RS-232 connector is guaran-



teed by the use of a printed circuit board, allowing the connection of mismatched RS-232 devices.

Price: \$24.95 each.

Remark Datacom Div. of Telebyte Technology, Inc., 148 New York Ave., Halesite, NY 11743; (516) 423-3237.
CIRCLE 338 ON READER SERVICE CARD

Naked Mini 4 family expanded

The NM 4/12—newest member of Computer Automation's Naked Mini 4 family of computer systems—offers high-performance 16-bit functionality at a cost reduction of as much as \$745 per unit over the NM 4/10.

The half-card NM 4/12 processor features 128K of on-board, dynamic RAM memory addressable in byte or word mode, and is fully compatible

with all NM 4 hardware and software. State-of-the-art VLSI technology is used in the NM 4/12, giving the processor its 16-bit, high-level functionality. Its architecture includes eight programmable registers, six levels of priority-vectored interrupts, seven processor traps, direct memory access, and auto and programmed I/O data transfers.

The NM 4/12 uses current bipolar and NMOS memory technology to provide 128K of dynamic RAM. By placing the memory on-board, instruction and data retrieval times are reduced. Active DMA execution allows processing to occur in parallel with direct memory transfers when RAM references are not required.

Up to 32K of on-board EPROM is available in optional sockets provided for the user. Under software control, the EPROM can be enabled or disabled, overlaying the top portion of the NM 4/12 address space. A switch-selectable option allows program execution to begin at the first EPROM address upon power-up. Standard option is for cold-start boot



Workman & Associates
112 Marion Avenue, Suite 1C
Pasadena, CA 91106
(213) 796-4401

MINIMUM DATABASE

Don't want to spend \$400 on dBase-II to organize your mailing lists? Would you like to have the source to your recipe keeper? The Minimum Database is what you need. It keeps track of almost any database and comes with the CBASIC-II sources.

Now only \$49.50!!!!!!!!!!!!!!!!!!!!!!!!!!!!

THE FILE TRANSPORTER

If you own more than one machine, you know how difficult it is to move files between them. One copy of The File Transporter will move any file between CP/M machines. It'll even send to CP/M-86 machines! Requires matching ports (serial or some parallel) or modems. A very detailed manual is included.

The File Transporter is \$69.50.

Disk formats include: 8", Apple CP/M, Osborne, Xerox, KayPro, Monroe, and Otrona. Please request our catalog.

CIRCLE 278 ON READER SERVICE CARD

Uniforth

One of the finest implementations of the FORTH language. Field tested and reliable, **UNIFORTH** is available for the DEC Rainbow/Professional, Osborne, KayPro, and IBM PC as well as most systems with 8" disks and the following processors:

8080	PDP-11
Z80	68000
8086/8	16032

As a task, **UNIFORTH** is compatible with and supports all features and file types of the CP/M, CDOS, MS-DOS and DEC operating systems. As an operating system, **UNIFORTH** will function "stand-alone" on most commercial microcomputers.

The FORTH-79 Standard language has been extended with over 500 new words that provide full-screen and line-oriented editors, array and string handling, enhanced disk and terminal I/O, and an excellent assembler. Detailed reference manuals supply complete documentation for programming and system operation, in an easy-to-understand, conversational style using numerous examples.

Optional features include an excellent floating-point package with all transcendental functions (logs, tangents, etc.), the MetaFORTH cross-compiler, printer plotting and CP/M file transfer utilities, astronomical and amateur radio applications, word processing, etcetera.

Compare these features with any other FORTH on the market:

- Speed and efficiency
- Ease of use
- Variety of options
- Documentation quality

You'll find **UNIFORTH** is superior.

Prices start at \$35. Call or write for our free brochure.

Unified Software Systems

P.O. Box 2644, New Carrollton, MD 20784, (301) 552-9590

CP/M Digital Research, CDOS Cromenco, DEC PDP Digital Equipment Corporation, MSDOS Microsoft, IBM PC IBM, Z80 Zilog

CIRCLE 274 ON READER SERVICE CARD

4th

A Powerful Software Development Tool.

4th is a compact, interactive software package which provides its user with a total software development environment. When used on a 48K CP/M operating system, this new, unique tool has the following features:

COMMAND LINE INTERPRETER

☐ Direct execution calculator mode ☐ Online module assembly/compilation ☐ Interactive module execution & debug ☐ Nested CP/M named source file loading ☐ CCP/utility functions (DIR, PIP, etc.)

LANGUAGE ☐ Fast compilation & execution ☐ Compact, modular structured code & data ☐ Top-down design with bottom-up coding ☐ Extensible: create new code & data types ☐ 16 & 32 bit integers, variable strings ☐ IEEE single precision floating point ☐ Sin, Cos, Tan, Arc, Log, Exp functions

ASSEMBLER ☐ Fully structured with 8080 mnemonics plus Z80 extensions ☐ Assembler code allowed within a high-level 4th module ☐ Easy interfacing to special hardware

LINE EDITOR ☐ Direct, fast source editing from 4th ☐ CP/M named source modules (no screens)

TRACER/DEBUGGER ☐ Run-time stack display & execution trace ☐ Decompile/disassembles all 4th code ☐ Interactive "patching" of compiled code

CROSS COMPILER ☐ Generates compact CP/M COM files ☐ Allows generation of ROMable code

PACKAGE: 190 page manual & 8" SS/SD disk

PRICE: \$89.95 + \$5.00 handling

TERMS: COD, check or money order; License required

UE United Controls Corp.
P.O. Box 4620
Huntsville, AL 35802
205/837-6144

CIRCLE 82 ON READER SERVICE CARD

What's Better Than Basic?

BASIC B+™ IS!

Delphic Systems has merged its Z80 BASIC with FairCom's MICRO B+™ to produce **BASIC B+™**, the first all purpose interpreter featuring a B-TREE file structure implemented using **NEW** commands. No more messy CALLS or difficult assembly language interfacing! Instead, use the following **BASIC B+™** functions to manage an index without ever reorganizing the file:

BOPEN	BCLOSE	NEWB
KILLB	FINDB	GETB
NEXB	PREVB	STATS

In addition, **BASIC B+™** was written using Z80 code in order to minimize size and enhance speed performance.

Features & Requirements

- Search a 10,000 entry index in one second
- No index reorganization needed
- Uses fast and compact Z80 code
- CP/M®
- 12 Digit precision
- Program Chaining
- Read only file protection
- Sequential and random files

BASIC B+™
with documentation
\$325.00
Delphic Systems
443 N. New Ballas Road
St. Louis, MO 63141
314 / 567-9708
Coming Next
INVENTORY B+™

VISA MasterCard
MICRO B+™ is a Trademark of FairCom

CIRCLE 216 ON READER SERVICE CARD

New Products

continued . . .

from the first available I/O device upon power-up or console-initiated autoload.

Additional memory features include a byte parity check to maintain system integrity and the provision of RAM battery backup terminals (requires +5V regulated). For applications requiring regulation of battery power, a low-cost half-card option with DC input range of 6 to 12 V is available.

The NM 4/12 is supported by three of Computer Automation's operating systems: OS4, RTX4, and OPUS-1. The OS4 is a disk-oriented programming system that includes a comprehensive set of software for developing and executing programs. The RTX4 (Real-Time Executive) provides the basic tools necessary for building real-time application environments. The OPUS-1 is a multiuser, multitasking system that automatically allocates memory and disk resources, and accommodates up to 16 I/O devices.

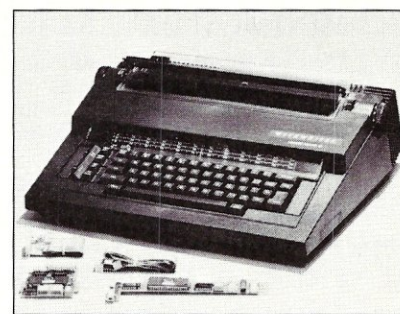
Price: \$1,600 in single-unit quantity.

Computer Automation, Naked Mini Division, 18651 Von Karman, Irvine, CA 92713.

CIRCLE 339 ON READER SERVICE CARD

Printers and interfaces from Bytewriter

Bytewriter has added two new printer/typewriters to their line and is selling interface kits as well. Until now, the Bytewriter was offered only



as a complete daisywheel printer based on the Olivetti Praxis 30 typewriter. With the increasing availability of the Praxis series typewriters from discount stores, the demand for the interface in kit form has increased. Now, owners of a Praxis typewriter can install the interface themselves and in less than an hour can be outputting letter-quality printing from their computer.

PROGRAMMER'S GUIDE TO CP/M[®]

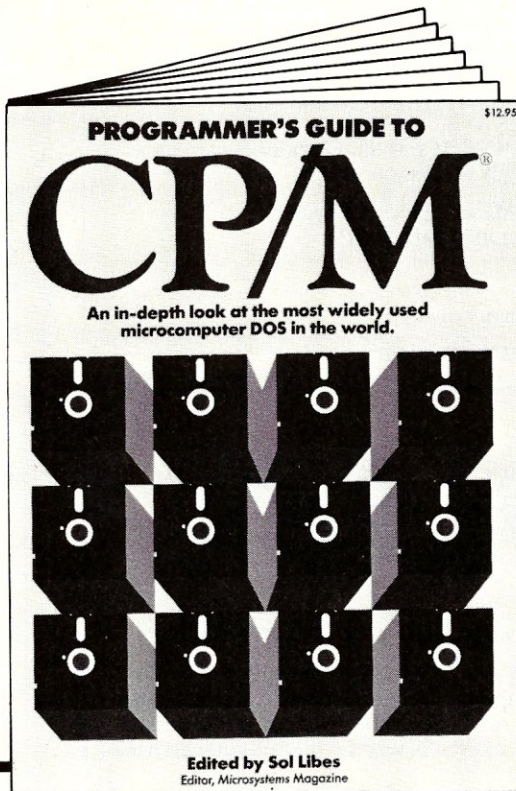
Edited by Sol Libes

Here's an important collection of CP/M insights that you'll never find in any CP/M manual. CP/M is the most popular microcomputer DOS in use today, and this widespread use has generated many innovative techniques and enhancements of CP/M. *Programmer's Guide to CP/M* tells you what these enhancements are and how to put them to use, how to get around apparent limitations of a CP/M system and why CP/M is far more versatile than you might have imagined. Every article in *Programmer's Guide to CP/M* originally appeared in MICROSYSTEMS between

January 1980 and February 1982. Except for this collection, these articles are now unavailable! *Programmer's Guide to CP/M* gives you an in-depth look at CP/M from the viewpoint of the programmer—the individual who creates the software that interfaces directly with CP/M, or who is installing CP/M on systems for which configurations do not already exist.

Contents include "An Introduction to CP/M," "The CP/M Connection," "CP/M Software Reviews," "CP/M Utilities & Enhancement," "CP/M 86" and "CP/M Software Directories." \$12.95.

Also available at your
local bookstore or
computer store.



For faster service,
PHONE TOLL FREE
800-631-8112
(In NJ only:
201-540-0445)

CP/M is a registered trademark of Digital Research, Inc.

MICROSYSTEMS PRESS

Dept. N62F • 39 East Hanover Avenue • Morris Plains, NJ 07950

Please send me _____ *Programmer's Guide to CP/M* at \$12.95* plus \$2.00 postage and handling each. Outside USA add \$3.00 per order. #14C

☐ **PAYMENT ENCLOSED** \$_____. *Residents of CA, NJ and NY State add applicable sales tax.

☐ **CHARGE MY:**
(Charge and phone orders \$10 minimum.)

☐ American Express

☐ MasterCard ☐ Visa

☐ Send me a FREE *Creative Computing Catalog*.

Card No. _____ Exp. Date _____

Signature _____

Mr./Mrs./Ms. _____
(please print full name)

Print Name _____

Address _____ Apt. _____

City _____

State _____ Zip _____

MOPI

the

NO Language Assembler/Compiler

If you're interested in voice operation, the computer language of the future, then consider MOPI, a first step towards the future, 'VIPI'.

*Have you Shied away from Assembly Language Programming?
Are you Frustrated with your current so-called High Level Compiler?
Worried about someone Pirating your Software?*

THEN SWITCH TO MOPI

A new type of software development package.
Generates machine code for any 8 bit microprocessor, using user defined instructions.
Easier to use than any other high level assembler/compiler.
All modules Contain a Serial Number for Identification Purposes.
Expandable to include new features as they are required, never a need to buy a new MOPI.
Maintains its own Documentation, from Data contained in the Source files.

We can supply you with any optional software you require.

MOPI Software: \$150 Plus (depending on options), Manual Only: \$35
Currently Available for use with CP/M and 48K memory.
Write, concerning availability on other systems.

VOICE OPERATED COMPUTER SYSTEMS
P.O. Box 3705, Minneapolis, MN. 55403

*CP/M is a trademark of Digital Research
**MOPI and VIPI are trademarks of Voice Operated Computer Systems

CIRCLE 81 ON READER SERVICE CARD

New Products

continued . . .

The interfaces are available for the Praxis 30, 35, and 40 typewriters and are prewired and tested for a retail price of \$165.

In a further effort to bring inexpensive letter-quality printing to the computer world, the normal dealer markup has been taken off the retail price. Thus the Praxis 30 Bytewriter has been reduced from \$695 to \$495. The Praxis 35 and the new Praxis 40 are also available now as completed printer/typewriters priced at \$545 and \$645, respectively. As with the Praxis 30, the interface fits entirely inside these machines. Only a cable is needed between the computer and the Bytewriter, and these are also stocked by Bytewriter.

Bytewriter, 125 Northview Rd.,
Ithaca, NY 14850; (607) 272-1132.
CIRCLE 340 ON READER SERVICE CARD

Speedpro-5

The Speedpro-5, which consists of a Zilog Z80B microprocessor and support circuitry mounted on a PC board that piggybacks onto the main board of the Kaypro, significantly

EP-PLOT[®]

EP-PLOT: The Plot Program that is also a Plotter

EP-PLOT converts your MX-80 or FX-80 with GRAPTRAX into a high resolution digital plotter with the same command language as a Houston Inst. DM/PL+ plotter plus much more. Produce high resolution plots without an expensive plotter. If you have CP/M-80, an MX-80 or FX-80, with EP-PLOT, you can now have full plotting capability for \$180.00.

EP-PLOT \$180.00
Demonstration Disk \$15.00

(refundable with system purchase)

Available for CP/M in 8" SSD and 5" NorthStar SSD

Order Now — Send Check or Money Order to:

SYMBOLIC SYSTEMS[®]

3138 Via Loma Vista, Escondido, CA 92025
Mail to: P.O. Box 1825, Escondido, CA 92025
(Calif. residents add 6% sales tax)

GRAPTRAX is a reg. trademark of EPSON-AMERICA Inc.
DM/PL+ is a reg. trademark of Houston Instrument Inc.
CP/M is a reg. trademark of Digital Research Inc.

CIRCLE 65 ON READER SERVICE CARD



IF YOU USE AN OSBORNE[™] YOU'LL ♥ A/N SOFTWARE!

Financial Utility I is a package of 26 interactive programs designed by a CPA and written by professional programmers. It can save you time when you need fast answers in the areas of loans, forecasting, investments, and present value and internal rate of return analysis.

Financial Utility I is menu driven and very friendly. A perfect package for first-time or experienced users. Changing variables is a snap, allowing you to construct "what if" situations with ease. Commands are logical and reports are preformatted.

Financial Utility I is competitively priced. See it at your dealer or call or write for additional information.

A/N SOFTWARE Inc.

P.O. Box 895, Melville, NY 11747
(516) 549-4090

Osborne[™] is a trademark of Osborne Computer Corporation

CIRCLE 3 ON READER SERVICE CARD

EYE GUARD™

LEAD IMPREGNATED TERMINAL SCREEN SHIELD

Eye-Guard is a VDT screen shield made of the same protective lead-impregnated acrylic used to shield workers in x-ray rooms and nuclear power plants. Cuts glare as well as most types of radiation that may be emitted by malfunctioning computer terminals. Attaches easily to most computers with convenient Velcro™ tabs.

\$129⁹⁵

**30-DAY
MONEY BACK
GUARANTEE**

PLUS \$4.00 SHIPPING & HANDLING

To order with a credit card or for more information CALL TOLL-FREE

800-221-7070

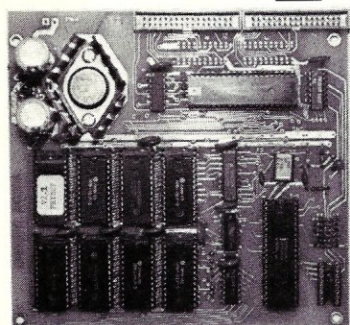
In New York CALL (212) 989-6876

Langley-St.Clair

Instrumentation Systems, Inc.
132 W. 24th St. New York, NY 10011

CIRCLE 37 ON READER SERVICE CARD

Dirt Cheap.



MX-80 COMPATIBLE PRINT BUFFER

\$49⁵⁰

System consists of:
Bare board, software in ROM
and complete documentation.

•\$2.50 SHIPPING

- Uses popular 2K or 8K byte wide RAMs for expansion to 14K or 56K.
- Automatic adjustment for RAM size.
- Diagnostics and status indicators supported.
- Parallel interface (Centronics and Epson compatible).
- Clear, copy and pause switches supported.
- Requires only 7 non RAM ICs: (8085, 8155, 74LS373, 74LS138, 74LS32, 74LS121, 74LS14)
- Small 6" x 6" size.

ADCOM SYSTEMS
P.O. BOX 345 • MILFORD, OHIO 45150
(513) 831-1561

Ohio Residents Add 5.5% - Add \$3.00 For C.O.D. Orders
CIRCLE 7 ON READER SERVICE CARD

OPTIMIZING C86™

is now (8/15/83) in Beta Test.

Call us to see if it is available now.

Any customers who purchase the current product will be able to upgrade to Optimizing C86 without charge.

It includes the following improvements from C86 1.33:

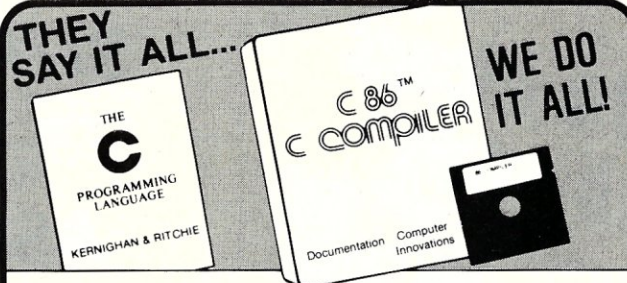
- Substantially **faster execution speed** of the programs you write. We've seen some programs run 300% faster. Overall speed has been improved along with I/O and string handling.
- **1,000K Addressing** of code and data is supported as a compile-time option - "Large Model"

When released commercially it will also have:

- **Object module format** compatible with your OS and Assembler
- **8087 code inline** (faster execution)
- Option for **Assembler output** from the compiler
- Extra functions for **MSDOS 2.0**
- **New manual** has examples for every library function

Other Notes:

- **ISAM** products and products compatible with C86 and with OPTIMIZING C86 are available from some of our customers. **Graphics** and **screen** manipulation function libraries are available. Ask for a product list.
- **C.to_dBASE™** is in Beta Test by CI. It is a package to interface C86 with dBASE files. Heavily annotated source to the product and a function library are included. Save time and learn C86 quickly.
- A **C86 User's Group** is being formed.



C86™ - For Professional Programmers OFFERS "C" FOR PC-DOS, CPM-86, MS-DOS, MPM-86:

- **FULL IMPLEMENTATION** of C—Syntax and Library.
- **NO ROYALTIES**—include routines from our Library in your commercial software without paying us royalties.
- **LIBRARY SOURCE** makes customization easy for you.
- **LIBRARY EXTRAS** include math, trig, much more.
- **FAST CODE**—the January Byte benchmark showed C86 to be fast, **8087 support** is included.
- **OVERLAY SUPPORT** helps with large programs.
- **A LIBRARIAN** supports object and source modules.
- **ROMABLE** programs may be written.
- **ASSEMBLER** may be included to write a function.
- **HOTLINE SUPPORT** brings competent and prompt help.

See your local Dealer or Call Computer Innovations to

- ☐ Buy C86 for \$395.
- ☐ Get Details.

All formats available:

PC, Rainbow, Victor, Z100, etc.
VISA and MasterCard accepted.

C86 is a trademark of Computer Innovations. CPM-86 and MPM-86 are registered trademarks of Digital Research. MSDOS is a trademark of Microsoft. PC-DOS is a trademark of International Business Machines.

Prices subject to change without notice.



Computer Innovations, Inc.
10 Mechanic St.
Suite J-151
Redbank, NJ 07701
Phone: (201) 530-0995

**Library
Source** helps:

cut size of programs, support new hardware, get compatible with another compiler's library.

OPTIMIZING C86 and C.to_dBASE are trademarks of Computer Innovations. dBASE is a trademark of Ashton-Tate.

CIRCLE 209 ON READER SERVICE CARD

improves the utility of the Kaypro II and IV portable computers. It doubles the processing speed from the standard clock speed of 2.5 MHz to 5 MHz, making the Kaypro one of the fastest 8-bit micros on the market. A DIPswitch on the Speedpro-5 board allows the user to select double speed, standard speed, and zero or one of the wait states.

The Speedpro-5 is fully compatible with all CP/M software used on the Kaypros, considerably improving response times, particularly for Perfect Calc and the S-Basic compiler.

Installation of the Speedpro-5 is quite simple and can be done by either the dealer or purchaser. All connections are by ribbon cable with DIP connectors, so no soldering is required. Complete installation and operating instructions are included.

Price: Speedpro-5 is available through most Kaypro dealers for \$74.95, customer installed.

Digital Dynamics, P.O. Box 5653, Tacoma, WA 98405; (206) 627-0797.
CIRCLE 341 ON READER SERVICE CARD

Static control mat

Protech Data, Inc., has introduced a static control computer mat designed to safely dissipate the static charges that can cause extensive damage to both software and hardware, such as erratic data transmission, loss of program, damage to disks, and even component failure.

Protech's static control mat is placed under the computer, and static discharge is accomplished by



touching the mat with the hand before operating the computer or accessories.

Price: \$79.

Protech Data, Inc., P.O. Box 2472, South Portland, ME 04106; (207) 799-0124.

CIRCLE 342 ON READER SERVICE CARD

"Dancing Sailors"

A new option is now available for Houston Instrument's DMP-40 plotter. Dubbed the "Dancing Sailors," this dual-pen assembly enables DMP-40 users to generate two-color plots or plots employing different line widths, all without operator intervention.

Taking advantage of the firmware already resident in the plotter, a simple command directs the DMP-40 to place the alternate pen in plotting position. Since both pens are carriage mounted, pen changes are fast and certain.

The DMP-40 can be ordered with the dual-pen option already installed for \$995, as the DMP-40-2. Also available as a factory or authorized-dealer conversion, retrofitting provides owners a quick and reliable way of obtaining multicolor plots.

Houston Instrument (a Division of

Now on IBM PC too!
"Q-PRO 4 blows dBASE II away"

We now complete complex applications in weeks instead of months."

says Q-PRO 4 user,
Richard Pedrelli, President
Quantum Systems, Norcross, GA



"As a dBASE II beta test site the past two years, we were reluctant to even try Q-PRO 4. Now we write all our commercial applications in Q-PRO 4. We find it to be an order of magnitude more powerful than dBASE II.

Q-PRO 4's 4th generation syntax is so efficient, we now complete complex jobs in weeks instead of months. Superb error trap and help screen capabilities make our finished applications far more user friendly. And our programs run much faster, too.

In my estimation, any application programmer still using outdated 3rd generation data base managers or worse, a 2nd generation language like BASIC, is ripping himself off."

Runs with PC/DOS, MS/DOS, CP/M, MP/M, TurboDOS™, MmmOST, N/STAR.
PRICE: C/P/M version—\$395. All others—\$595. Moneyback guarantee.
Author's lock up package available.

Quic-n-easi products inc.

136 Granite Hill Court, Langhorne, PA 19047 (215) 968-5966

PC/DOS, MS/DOS, CP/M and MP/M, TurboDOS, MmmOST, N/STAR and dBASE II are registered trademarks of IBM, Microsoft, Digital Research, Software 2000, TeleVideo, Molecular Computer and Ashton Tate respectively.

CIRCLE 196 ON READER SERVICE CARD

SUPER-FAST!
Z80

Relocating Macro
ASSEMBLER
\$169.95

Directly generates COM, HEX, or REL files. Flexible REL format allows external bytes and words with complete math operations on them (Microsoft format optional). Features Zilog mnemonics with nested macros, conditionals and include files. Unique one-pass design generates compact intermediate code which is then processed to resolve forward references, yielding tremendous time savings. Complete listing, symbol table and cross-reference output may be sent to any device. The perfect tool for assembly language programming. Linker included. Manual only — \$30. For Z80 CP/M and TRS-80.

S L R Systems

1622 NORTH MAIN ST. • BUTLER, PA 16001 • (412) 282-0864

Shipping \$3 U.S., others \$7. PA + 6%. Check, MO, VISA, M/C, C.O.D. Most formats available. Dealer and OEM inquiries invited. Z80, CP/M, TRS-80 TM's of Zilog, Digital Research, Tandy Corp.

CIRCLE 53 ON READER SERVICE CARD



**the best VALUE anywhere
COMMUNICATIONS SOFTWARE PACKAGE
COMMx-PAC™**

- COMMx Smart Terminal and File Transfer Auto Dial and Logon Files for Easy Linkup Protocols for Timeshare, MODEM 7, CRC16 FORTRAN version available for Mainframes
- Unattended "Midnite" Electronic Mail Subsystem
- CONSOLX Remote Operation of Your Computer
- Bulletin Board System with Database Access
- Database File Management System Included
- Utilities for Data Encryption, Compression, and More
- CPU License \$150 Detailed Manual \$25



Contact Your Local Dealer or
Call or Write For Free Brochure

HAWKEYE GRAFIX

23914 Mobile, Canoga Park, Ca. 91307 • 213/348-7909 U.S.A.

CIRCLE 41 ON READER SERVICE CARD

EASI Structural Designs

Structural Design Programs:

Concrete — Beam, Column,
Slab (1 way & 2 way)

Steel — Beam, Column

\$99⁰⁰ each or \$400⁰⁰ Complete Set

Also

Structural Analysis Programs:

Finite Element Method —

Frames, (2D - 3D)

Trusses, Plates, Grids, Membranes,
Out of Core Solver, Thermal, etc.

\$200⁰⁰ — \$500⁰⁰

Critical Path Project

Management Programs:

Standard Version \$200⁰⁰

Corp. of Engineers Compatible \$200⁰⁰

Complete Set \$300⁰⁰

EASI Software, Inc.

c/o Henry Camin, Jr.

2891 Livonia Center Road

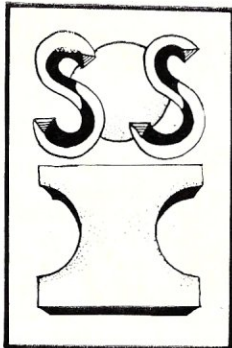
Lima, N.Y. 14485

or telephone (716) 346-2022

or (201) 367-5735

CIRCLE 219 ON READER SERVICE CARD

LARGE INVENTORY AVAILABLE FOR IMMEDIATE DELIVERY



SMITH SYSTEMS INC.

215 JOLIET ST. SUITE #1

DYER, IN 46311 PH. 219-865-6010

MIDWEST DISTRIBUTORS FOR

HDL RESEARCH S-100 MAIN FRAMES

MCS-112 DESK 12 SLOT W/CVT PWR \$737

MCS-122 DESK 22 SLOT W/CVT PWR \$881

RM-12 RACK 12 SLOT W/CVT PWR \$879

RM-122 RACK 12 SLOT W/CVT PWR \$1036

DDE-8 DISK ENCLOSURE W/CVT PWR \$910

DDE-8R DISK ENCLOSURE W/CVT PWR \$1015

TF-12 12 SLOT W/SP FOR 2-5" DRVS \$960

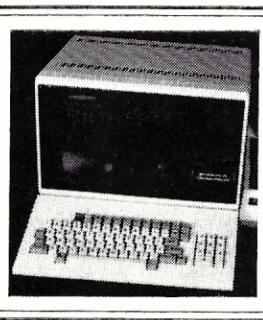
Ready To Run Systems Available Now
(Dealer Inquiries Invited)

SYSTEM COMPONENTS

8" QUME DT-8	DS/DD \$475
8" MITSUBISHI THINLINE	DS/DD \$464
CCS 2810 Z-80 4 MHZ CPU	\$245
TARBELL DD FLOPPY DISK CONT	\$425
MEMORY MERCHANT 64K STATIC	\$419
PMMI 300 BAUD S-100 MODEM	\$339
SSM I/O-8 8 PORT SERIAL	\$449
GEMINI 10X PRINTER PAR	\$CALL
ADDS VIEWPOINT ADM-3A+	\$545

COMING SOON

COMPLETE BAR CODE SYSTEM USING EPSON
OR GEMINI PRINTER & OUR WAND. WILL
WORK WITH A VARIETY OF COMPUTERS.
INCLUDING HDL, MORROW, SANYO, XOR



LAST MIN. SPECIAL 8" VERTICAL DRIVE CAB QTY(1) KITS \$195 ASM \$225

CIRCLE 55 ON READER SERVICE CARD

DISK/FILE CATALOGING SYSTEM

For 8080/Z80 CPM* Systems

ORGANIZE, LOCATE, IDENTIFY ALL FILES

- filenames, sizes, user numbers and user-entered notes instantly available
- powerful search directives simplify file location
- 255 disk capacity per data-base; unlimited number of data-bases
- no limit on number of files per data-base
- locates "hidden" files
- shows space used on each/all disks

\$75, plus shipping and handling

No other program can do what CATALOG does... Computer record keeping has come of age!

Dealer and OEM inquiries welcome.

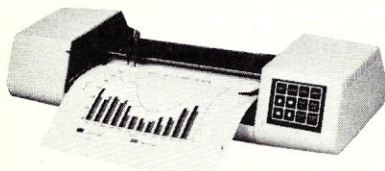
*CPM is a registered trademark of Digital Research



2812 Westberry Drive
San Jose, CA 95132
408/926-9411

CIRCLE 42 ON READER SERVICE CARD

New Products continued . . .



Bausch & Lomb), 8500 Cameron Rd., Austin, TX 78753; (512) 835-0900.

CIRCLE 343 ON READER SERVICE CARD

Electronic surge suppressor

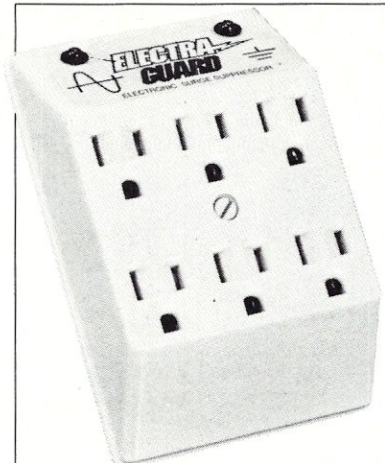
Computer Power Solutions, Inc., has added a new model to its line of surge suppressors for AC power lines. The Electra-Guard System 2 is a solid-state clamping device designed to eliminate undetected submicro-second overvoltage transients from electrical circuits. Commonly referred to as "spikes" or "glitches," these transients can cause computer hardware and software damage to unprotected circuits. The Electra-Guard System 2 expands a standard two-outlet power receptacle to provide six outlets, and offers a very

inexpensive answer to potential equipment damage.

Threats to electronic equipment come from many quarters. On-line disturbances could result from sudden power-line voltage increases when certain kinds of equipment are switched on or off, or from malfunctioning voltage regulation. Off-line disturbances could result from lightning striking nearby.

Noise, voltage spikes, radio hash, spark transients, and other unwanted elements can appear on power lines from any number of everyday devices such as radio transmitters, appliances, power tools, neon lighting, and more. Electronic surge suppressors are designed to eliminate overvoltage transients from circuits, protect mini and micro computers, and sensitive computer-controlled equipment. Without such protection, computer logic can become scrambled, and memory banks can be lost.

The Electra-Guard System 2 (15 amps at 120 volts AC) can handle six devices not exceeding 1875 watts, providing line-to-line and line-to-



ground clamping protection with a response time of less than 5 ns to overvoltage spikes and surges, and is compatible with 50 Hz and 60 Hz AC power mains.

Price: \$49.95.

Computer Power Solutions, Inc., 8800 49th St. North, Suite 203, Pinellas Park, FL 33656; (813) 544-8801 or (800) 237-6010.

CIRCLE 344 ON READER SERVICE CARD



COMMUNICATIONS SOFTWARE

WHY BUY 3 PROGRAMS?
LYNC HAS ALL 3 IN ONE!

- 1) FILE TRANSFER 2) REMOTE OPERATION
- 3) COMMUNICATE WITH TIME-SHARE

Easy set up on most systems.
Menu driven install program.
Command Mode of operation
Help Screen for Lync & Term

Z80 based CP/M \$155
PC DOS \$155 TRSDOS \$75



We're Not the Biggest, Just the Best.

International Software Alliance (805) 966-3077
1835 Mission Ridge Santa Barbara, CA 93103

* DEALER AND OEM INQUIRIES INVITED *

FORMATS: 8" Standard; IBM PC DOS; TRS-80 Mod II with CP/M; VectorGraphic; Cromemco; North Star; Osborne; Xerox 820 (8" or 5"); SuperBrain; NLS KayPro; TeleVideo; TRS-80 Model I or III; Zenith/Heathkit; Victor 9000; Sanyo; Altos; Fujitsu; Otrona.

CP/M is a trademark of DIGITAL RESEARCH. LYNC is a trademark of MIDNIGHT SOFTWARE.

CIRCLE 43 ON READER SERVICE CARD



Z-100's include MS-DOS List Omni
ZF-100-21 (one floppy) 2899 2388
ZF-110-22 (2 floppies) 3499 2888
ZF-120-22 All-in-one 3599 2999
===NEW with 11MB HARD DISK===
ZW-110-32 (11MB HD) 5499 4599
ZW-120-32 (11MB HD) 5599 4699
Z-100 TECHNICAL MANUALS. (2 VOL)

ZVM-121 Green Monitor	159	119
ZVM-122 Amber Monitor	179	149
ZVM-131 Med Res Color	379	329
ZVM-135 High Res Color	599	519
Z-29 Smart Terminal	849	699

CP/M-85, CP/M-86, LOTUS 1-2-3
Microsoft PASCAL/FORTRAN/COBOL/C
Z-BASIC Interpreter & Compiler
PEACHTREE ACCOUNTING PACKAGES
Wordstar, Supercalc, Multiplan
Condor rDBMS, Peachtext-5000

Printers/Modems/Disks/Boards/Etc
CALL NOW FOR PRICE LIST & INFO

OMNI|DATA SYSTEMS

ATTLEBORO, MASS
617-222-0425

CIRCLE 100 ON READER SERVICE CARD

EPROMS USING CP/M

EPROM PROGRAMMING SYSTEM RUNS UNDER CP/M

PROGRAMS: 2708, 2758, 2716, 2732, 2732A, 2764 and 27128.

FEATURES -

- STAND ALONE BOARD
- ELECTRONIC SWITCHING OF EPROM TYPES
- ON BOARD SUPPLIES
- 28 PAGE MANUAL
- DESIGNED WITH EASY-TO-GET PARTS
- WORKS WITH ANY CP/M SYSTEM
- USES 24 VOLT XFMR FOR POWER

INTERFACES THROUGH ONE 8 BIT INPUT PORT AND ONE 8 BIT OUTPUT PORT. 16 WIRES - NO SPECIAL HANDSHAKE LINES.

CONTROL SOFTWARE COMMANDS -

- PROGRAM EPROM(S)
- FROM DISK FILE
- PROGRAM EPROM(S)
- FROM RAM
- READ DISK FILE INTO RAM
- COMPARE EPROM W/RAM
- VERIFY EPROM IS ERASED
- COPY EPROM
- DISPLAY/MODIFY RAM (MONITOR)
- (MONITOR HAS 11 SUB COMMANDS)
- FILL-DUMP-XFER-MODIFY ETC.)

ALSO AVAILABLE FOR OSBORNE 1 (TM)

BARE P.C. BOARD WITH COMPLETE DOCUMENTATION AND SOFTWARE ON AN 8" SINGLE DENSITY DISKETTE **\$69.**

TO ORDER SEND CHECK, MONEY ORDER OR CALL

WRITE OR CALL FOR MORE INFO. 513/752-7218

ADD \$3.00 SHIPPING Ohio res. add 5.5% tax \$3.00 for C.O.D.

VISA OR M.C. ACCEPTED

AndraTech
P.O. BOX 222
MILFORD, OHIO 45150

* CP/M is a trademark of Digital Research

CIRCLE 199 ON READER SERVICE CARD

SAL/80[®] and SAL/86[™]

do for assembly language what RATFOR does for FORTRAN but emits

OPTIMALLY DENSE code.

SAL/8X includes console I/O primitives which trivialize the task of writing complex interactive user interfaces. Improves programmer productivity by a factor of two and program maintainability by an order of magnitude.

Extensively documented, available for all CP/M compatible disk formats. SAL/80 version 2.1, \$59.00, requires 64K and MAC or RMAC.

CALIFORNIA RESIDENTS ADD 6% SALES TAX.

PROTOOLS[®]

"Software Tools for the Professional"

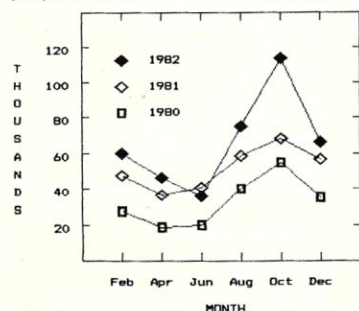
24225 Summerhill Avenue
Los Altos, CA 94022
(415) 948-8007

CIRCLE 256 ON READER SERVICE CARD

PUBLISHABLE QUALITY GRAPHS on MOST DOT MATRIX PRINTERS

Requires no Graphics Screen
Line Graphs and Scatterplots
Easy to Use, Excellent Manual
CP/M 80, CP/M 86
Most disk formats.
Price: \$50. Manual Alone: \$10.

DataPlotter from Lark Software
7 Cedars Rd, Caldwell, N.J. 07006
(201) 226-7552 Visa, M/C



CIRCLE 15 ON READER SERVICE CARD

MOTOROLA 68000 STRUCTURED MACRO CROSS ASSEMBLER

for CP/M-80* (8" SSSD)
EXORmacs† Compatible

\$200

Manual
\$20

Linker
included

Source
Available

farbware
1329 Gregory
Wilmette, Ill. 60091

*Trademark of Digital Research
†Trademark of Motorola Inc

CIRCLE 27 ON READER SERVICE CARD

Z80/8080/Z80 TRANSLATOR SAVE TIME - SAVE MONEY USE A MACRO PROCESSOR 39.95

Why waste time hand-translating assembly language mnemonics? The XLT macro processor is a powerful utility for translating from one language to another or extending the usefulness of a current language.

To translate, a file of definitions is read by XLT and compared to the input text. A match causes the input text to be replaced with the definition's contents.

XLT allows up to ten arguments in a definition, arguments containing spaces or tabs, incrementing/decrementing strings, a stack, and conditional text replacement.

Included are definitions for translating Z80 to 8080 mnemonics and vice-versa, and definitions to implement CSAL, a C-structured assembly language. This allows code like `add a, (hl)` to be written as `a += *hl`.

XLT costs 39.95 plus 5.00 shipping and handling. For CP/M 2.2 8" single density Z80 disk systems.

Send check or money order to:

L. A. Software, 6708 Melrose
Los Angeles CA 90038
213/932-0817

CA res. add sales tax CP/M is a trademark of Digital Research

CIRCLE 36 ON READER SERVICE CARD

MAGNOLIA MICROSYSTEMS

Makes the ZENITH 89/90 a REAL Business Computer



The solid **Dependability** of the Z89/90 with the **Flexibility** to configure it the way you need.

- Memory Boards 16-128 KBytes
- Hard Disk Interfaces and Subsystems 5-50 MBytes
- Floppy Disk Controller Mix 8" and 5" drives
- MMS-Net™ Networking
- High-Speed/High-Capacity Auxiliary Processor
- The most powerful, flexible CP/M™ available

Ask your Zenith dealer about Magnolia products

MAGNOLIA MICROSYSTEMS, INC
2264 15th Ave. West • Seattle, WA 98119
(206) 285 7266 (800) 426 2841
CP/M is a trademark of Digital Research

CIRCLE 244 ON READER SERVICE CARD

WHERE TO SELL YOUR PROGRAMS

1984 PROGRAMMER'S MARKET

Inside information on 500 microcomputer software publishers who use freelance material—

- what they need
- how to sell to them
- how much they pay

Edited by Brad M. McGehee

1984 Programmer's Market is a brand new directory featuring 500+ listings of software and arcade game publishers, plus computer magazines who buy freelance computer programs. Each listing gives contact name, address, submission requirements, pay rates, and tips from the buyers to help you target your efforts.

You'll also find five articles on how to sell your programs—how to:

- prepare a query letter and proposal package for submission
- write user manuals to accompany your software
- document your program
- write user-friendly software
- write game programs that will sell

1984 Programmer's Market gives you complete details—at an affordable price—to sell your computer programs to the right publisher! 300 pages/\$16.95, paper

Available at bookstores everywhere... or ORDER YOUR COPY TODAY WITH THIS COUPON

YES! Please send me _____ copy(s) of 1984 Programmer's Market @ \$16.95 ea., plus \$1.50 postage & handling for one book, 50¢ for ea. add'l book. (Ohio residents add sales tax.)

☐ Payment enclosed ☐ Please charge my: ☐ Visa ☐ Mastercard

Acct. # _____ Exp. Date _____

Signature _____

Name _____

Address _____

City _____

State _____ Zip _____

Send to: **Writer's Digest Books** 9933 Alliance Road Cincinnati, Ohio 45242

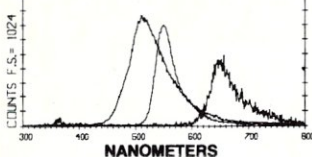
1246

CIRCLE 86 ON READER SERVICE CARD

Microsystems Mart

PRINTER GRAPHICS

FLUORESCENT DYES
COUMARIN, RHODAMINE, NILE BLUE



From: Basic, Fortran, PL1, or any language with disk I/O, you can generate high resolution plots and graphs on your MX80 (with grafrax), DMP 85, 8510 prowriter or Radio Shack CGP 115.

- Built in character generator with rotation and size control.
- 2 & 3 D Cartesian coordinates systems
- Commands for: Circle, ellipse, Sector, Arc, Draw and move incremental and absolute, pen up and down, graph border, generator for graphs and Math functions.

When order please specify Printer
Requires 48K, 8080, 8085, Z80

Price \$99.95

M.E.S.C.

Parkhurst Dr.
Salisbury, Md. 21801
Phone - 301-742-7333
Ph. orders - 301-742-7333
Technical Information 6:00-9:00 PM Eastern Time



Automatic Micro

Smartboard™ RC100 - Remote Control Relay Interface
Reliable, flexible control of up to 16 bi-stable relay switches.

- S-100 compatible
- 16 channels relay control & status
- All inputs/outputs optically isolated
- Onboard 8035 CPU and 4 Status/Command registers allow easy control & communication with main CPU
- Relay state unaffected by power outages
- Zero voltage switching for extended relay contact life
- Port or Memory mapped addressing
- Fully Documented
- External 2716 or 2732 EPROM allow custom programming for application flexibility
(Designed for GE RR8 remote control relays)

RC100 Remote Control Relay Interface \$495.00
RR8 relay (ea) \$17.95
DB-25 connector cable (ea) \$24.95

Dealer inquiries invited!

Automatic Micro, Inc.
P.O. Box 20007
Columbus, Ohio 43220

ELF—The Statistical Package
Reads All...Writes All
For IBM, Apple, and CP/M

FEATURES

- Reads and writes from VisiCalc, SuperCalc, dBase II, dIF, etc.
- Factor analysis and principal components
- Stepwise regression
- Stepwise discriminant analysis
- Analysis of variance (1 and 2 way)
- Mean, standard deviation, etc.
- T-test on means
- Crosstabs
- Frequencies
- Histograms
- Create and revise a database
- Complete transformation language
- Report writer
- Software numeric keypad
- more...

CAPACITY

DATABASE: Observations: unlimited (multi-diskette). Variables: IBM 350+, Apple 250, CP/M 150. **ANALYSIS (minimum)** IBM 35+, Apple 25+, CP/M 15+. Note: some CP/M machines require smaller capacity version.

PRICE

IBM \$350, MS DOS \$350, Apple \$200, CP/M \$200, CP/M 86 coming soon. To order or for further information write or call:

The Winchendon Group, Inc.,
PO Box 10339, Alexandria, VA 22310
(703) 960-2587

MC/Visa

Trademarks: VisiCalc; VisiCorp; dBase II; Ashton-Tate; SuperCalc; Sorcim; ELF; The Winchendon Group, Inc.

The DELPHI SYSTEM 15 Megabyte HARD DISKS

for

KAYPRO, XEROX 820, Big Board
Televideo and S-100 computers

\$2595 complete

- 15 megabyte hard disk drive with plated media
- switching power supply and enclosure
- controller, cables and CP/M software

DELPHI DEVELOPMENT

6273 19th Ave. NE
Seattle, WA 98115
(206) 524-5369

αβγδεζηθικλμνξοπρστυφχψωΓΔΘΛΣΠΤΦΨΩ*

Turn WORDSTAR™ into a
TECHNICAL WORD PROCESSOR
by adding CHARTECH.
Use with most popular printers
having dot-addressable graphics.

$$\lambda = \sum_{n=1}^{\infty} [r_{\alpha\beta} + n_{\gamma\nu}]$$

94 special characters printed.
New characters easily added.
Special characters displayed
on the screen for some systems.
Screen formatting of equations.
All printer functions accessible.

Plain CHARTECH is \$95.
Enhanced version is \$130
(Plain version displays characters
resident in the terminal, enhanced
version forms screen characters in
software for certain systems.)
Special screen character ROMs
available for some systems.
Presently available for 8-bit
systems using CP/M™.
Ask your local dealer or order
directly from

TECHWARE, 2510 Cresta de Ruta
Eugene, OR 97403, (503) 343-0566.

State computer, disk density,
and release of WordStar.

αβγδεζηθικλμνξοπρστυφχψωΓΔΘΛΣΠΤΦΨΩ*

ISIS ↔ CP/M®

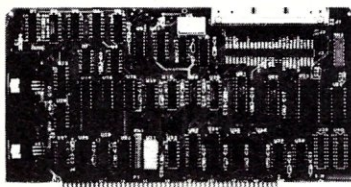
Full bi-directional file transfer capabilities are provided in the ISIS-CP/M utilities package. Written in machine language and running under CP/M, these utilities permit the CP/M user to read or write files direct to/from an ISIS Diskette. They will run under any version of CP/M without regard to diskette density. The complete package is \$250.00 including user's manual. Write for free brochure on other CP/M software.

CP/M is a registered trademark of Digital Research
ISIS is a trademark of Intel Corporation



**SOUTHERN
COMPUTER
SYSTEMS, INC.**
P.O. Box 3373A
Birmingham, AL 35255
(205) 933-1659

FEEL TRAPPED BETWEEN CAPACITY AND COST?



Processor Interface introduces the Cartridge Disk Controller for the S-100 bus. Configurable for 12 sector 2315 and 5440 type disk drives (1.25-10 Mbytes per drive). Complete with CPM™ BIOS, disk formatter diagnostics and technical manual low cost \$595.00

Manual only \$25.00
The performance
you need at
a cost you can
afford



Processor Interfaces, Inc. P.O. Box 154A Elm Grove, WI 53122
414-785-1245

S-100 COLOR GRAPHICS MUSIC SYNTHESIS DUAL I/O PORTS

SINGLE BOARD DESIGN USES ONLY 22 IC'S

COLOR GRAPHICS

- TMS 9918A Video Display Processor -On board RF Modulator
- 256 x 192 pixel resolution
- NTSC composite video connector
- 16 unique colors
- 1 text and 3 graphic modes
- 16K of display RAM (4116's)
- 32 sprites for 3D simulation

COMPLEX SOUND GENERATION

- AY-3-8910 Prog. Sound Generator
- 16 level amplitude control
- 3 programmable channels
- Noise generator
- Produces 3-note chords
- Envelope shape/cycle control
- Tones from 33 KHz to 125KHz
- Special sound effects

The AMUSIGRAF system is offered as an affordable package which includes the following:

- Bare S-100 P.C. Board
- AY-3-8910 data manual
- TMS 9918A data manual
- Complete user's documentation
- CP M™ compatible 8" disk with test and demo software

ORDER by mail through:
FORESIGHT TECHNOLOGY
Write or call for more information.

AMUSIGRAF SYSTEM
Introductory offer
Visa \$95⁰⁰ Master Card

Add \$3.00 for C.O.D.
Ohio res. add 5.5% sales tax
Send certified check or money order
for immediate delivery
Personal checks allow 2 wks.

* CP M is a trademark of Digital Research

ORDER by phone through:
ADCOM MKTO. SERVICES
(513) 831-1561

1016 Huffman Ct.
Cincinnati, Ohio 45231

Electronic Circuit Analysis

- AC and DC analysis
- Very fast, optimized machine language
- Infinite circuits on multiple passes
- Worst case, sensitivity analysis
- Sweep component values
- 64 Nodes, 127 branches
- Compare circuits
- Log or linear sweep
- Full file handling
- Full editing, error trapping
- Frequency response, magnitude and phase
- Complete manual with examples
- CP/M \$150.00
- Now available for MSDOS (IBM PC) \$150.00

Tatum Labs
P.O. Box 722
Hawleyville, CT 06440
(203) 426-2184

S-100 COLOR GRAPHICS CONTROLLER BOARD

Using NEC 7220 Graphics Display Controller

One board, single jumper configurable for 8-color mode or monochrome mode. For color, configures to 3 planes of 32K bytes for output to R-G-B TTL monitors. For monochrome to a single large 96K image plane.

For use with standard TTL monitors with separate synchronization: R-G-B or monochrome, 15.75 KHz horiz., 60 Hz vert. A composite output is available on the board for non-interlace monochrome monitors.

Select positive or negative sync - Each bit (pixel) is individually addressable - Built in algorithms for arcs, lines, rectangles, area fill - Light pen input - 1x to 16x zoom - Occupies two contiguous addresses on the system I/O bus - Interlace or non-interlace modes.

Programmable display window: 640x408 interlaced color, or 512x512 interlaced color, or 640x240 non-interlaced color and monochrome, or 640x480 interlaced monochrome, and others.

Using pan techniques enables viewing image areas larger than the display window most likely in non-interlace or monochrome applications, or when zoomed.

This is an extremely versatile, cost effective graphics controller for personal, home, and small business computers.

\$595 \$460 for partially stuffed board with less memory for monochrome - upgrade later.

PIXELTRONICS

1050 Tulip Way
Palatine, Illinois, 60074
(312) 359-1442

DISK DRIVES

TANDON FLOPPY

5 1/4"	TM100-1	SS/DD\$190.
5 1/4"	TM100-2	DS/DD\$245.
5 1/4"	TM101-4	DS/DD\$335.
8"	TM848-1	SS/DD\$355.
8"	TM848-2	DS/DD\$415.

TANDON WINCHESTER

5 1/4"	TM501	6 meg\$635.
5 1/4"	TM502	12 meg\$790.

COMPLETE HARD DISK SUBSYSTEMS
AVAILABLE FOR S-100, IBM PC, APPLE.

!PRICES START AT \$1,295.!

Computer Synthesis
5536 Colbert Trail
Norcross, Ga. 30092
(404) 441-2191

classified ads

CLASSIFIED RATES: Per Word, 15 Word Minimum.
REGULAR: \$1.35. EXPAND-AD: \$2.03. GENERAL
INFORMATION: Prepayment discounts available.
Payment must accompany order except credit card
— Am. Ex., Diners, MC, VISA (include exp. date) —
or accredited ad agency insertions. Copy subject to
publisher's approval; must be typewritten or printed.
First word set in caps. Advertisers using P.O. Boxes
MUST supply permanent address and telephone
number. Orders not acknowledged. They will ap-
pear in next available issue after receipt. Send order
& remittance to: Classified Advertising, MICRO-
SYSTEMS Magazine, 1 Park Avenue, New York, NY
10016. Direct inquiries to (212) 725-3927.

SOFTWARE

SOFTWARE WANTED. German distributor looking for
good programs. Offers to: C. Bintz, Huegelstr, 210, 6000
Frankfurt, W. Germany.

THE BEST OF PUBLIC DOMAIN CP/M SOFTWARE! Util-
ity Programs. Processor of Words, Catalog Disks, MUCH
MORE! Includes Complete User's Manual, 8" SS/DD only
\$28.95 or send for FREE information. UNITECH, BOX 98,
MANCHESTER, NY 14504.

ULTIMENU FOR DOS simplifies IBM's, PC-DOS to meet
your needs. \$24.95. DB/DC Software Associates, P.O. Box
4695, Manchester, NH 03108.

COMPUTER EQUIPMENT/SUPPLIES

FREE! Computer & Supplies Catalog—low prices—sat-
isfaction guaranteed—DATA SYSTEMS, Box 99, Fern Park,
FL 32730. (305) 788-2145.

COMPUTER PAPER—Save \$\$\$; Top quality. Low single
carton prices. Free samples. Shipping via UPS. Call A-1,
(800) 628-8736 or (213) 804-1270.

PUBLICATIONS

WHOLESALE Prices to Computer Club Members & In-
dustry! Southern Calif. customers only. Our customers in-
clude authors of articles in this magazine. Computers, Disk
Drives, Floppy Disks, Modems, Monitors, Paper, Print-
ers, Software, Terminals. Visit our demo rooms! PATIO
COMPUTER SALES CO., N. Hollywood. (213) 762-0020.

ALARMS

PROTECT MICROSYSTEMS AND ELECTRONICS! Free
catalog of systems for SCHOOLS, OFFICES, HOMES.
SGM Corporation, 6 West Main, Bound Brook, NJ 08805.
(201) 469-8585.

PROMPT DELIVERY! AND TRY TO BEAT THESE IC PRICES:

DYNAMIC RAM		
64K	200 ns	\$5.27
64K	150 ns	5.47
64K	120 ns	6.55
16K	200 ns	1.49
EPROM		
27128	300 ns	\$19.20
2764	250 ns	6.35
2732	450 ns	3.89
2732A-2	200 ns	5.67
2716	450 ns	3.19
2532	450 ns	4.60
STATIC RAM		
6264P-15	150 ns	\$33.00
6116P-3	150 ns	4.79
6117P-3	150 ns	4.20
Z80A FAMILY		
CPU, CTC, or P10		\$2.94
DART		7.99
DMA or SIO/O		12.50

MasterCard/VISA or UPS CASH COD
Factory New, Prime Parts

MICROPROCESSORS UNLIMITED
24,000 South Peoria Ave. (918) 267-4961
BEGGS, OK. 74421

μP

Prices subject to change. Please expect higher prices on some parts due to
world wide shortages. Call for volume prices. Subject to available quantities.
Shipping & Insurance extra. Cash discount prices shown.

RAM'S AND EPROM'S

4164	150ns	\$4.95
4164	200	4.80
6116P-3	150	4.50
6116LP-3	150	4.75
2716	450	3.15
2732	450	3.95
2764	250	6.00
2764	300	5.75
27128	250	CALL
2532	450	4.25
2564	450	8.50

8088, 8748, 8255, 8253 AVAILABLE

- ☐ Minimum order is \$25.00. Prices sub-
ject to change
- ☐ Distributors, Dealers,
OEM inquiries invited
- ☐ !!Call/write for latest price quotes!!

FREE BROCHURE

Excel-Tec Industries, Inc.

Post Office Box 2205
Silver Spring, MD 20902
(301) 434-4123

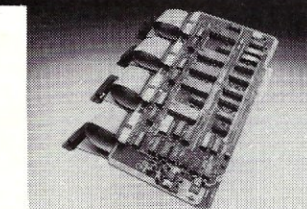
FREE CATALOG!

Just let us know and
we'll mail you a FREE
Creative Computing
Catalog—16 pages
filled with books,
buyer's guides,
magazines, and more!

To get your FREE
catalog, write to:

Creative Computing
Catalog

Dept. NAX
39 East Hanover Ave.
Morris Plains, NJ 07950



Multi-Port Serial Card for S-100 (IEEE-696) Systems

Designers who need an IEEE-696 serial
interface card have a choice of either 2 or
4 ports with the Multi-Port Serial Card.
Each port can operate as either a "data
set" or as a "data terminal." Independent
baud rate generators for each port (50 -
19.2k baud) and an 8-level vectored
interrupt controller are provided. 36"
cables are included.

Single Qty:

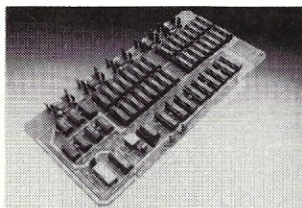
\$280 (4-port), \$210.00 (2-port).

Call: 1-800-426-8936

Dealer and OEM inquiries are invited.

Seattle Computer Products, Inc.

1114 Industry Drive, Seattle, WA 98033



64k Static RAM

for S-100 (IEEE-696) Systems

The fully static design makes it easy to
interface Seattle Computer's 64k Static
RAM board with a variety of CPU and
DMA devices in IEEE-696 systems.
High-speed (85 ns) RAM chips enable
operation to 10 MHz with no wait states.
Board can be used as either 8- or 16-bit
wide memory. 48k, 32k, and 16k OEM
versions are available.

Single Qty: \$495.00

Call: 1-800-426-8936

Dealer and OEM inquiries are invited.

Seattle Computer Products, Inc.

1114 Industry Drive, Seattle, WA 98033

BDS C

The fastest CP/M-80 C compiler available today

Version 1.5 contains some nifty improvements:

The unscrambled, *comprehensive* new User's Guide comes complete with tutorials, hints, error message explanations and an index.

The CDB symbolic debugger is a valuable new tool, written in C and included in *source form*. Debug with it, and *learn* from it.

Hard disk users: You can finally organize your file directories sensibly. During compilation, take advantage of the new path searching ability for all compiler/linker system files. And at run-time, the enhanced file I/O mechanism recognizes user numbers as part of simple filenames, so you can manipulate files located *anywhere* on your system.

BDS C's powerful original features include dynamic overlays, full library and run-time package source code (to allow customized run-time environments, such as for execution in ROM), plenty of both utilitarian and recreational sample programs, and *speed*. BDS C takes less time to compile and link programs than any other C compiler around. And the execution speed of that compiled code is typically lightning fast, as the Sieve of Eratosthenes benchmark illustrates. (See the January 1983 BYTE, pg. 303).

BD Software 8" SSSD format, \$150
P.O. Box 9 Free shipping on pre-paid orders
Brighton, MA 02135 Call or write for availability on
(617) 782-0836 other disk formats

CIRCLE 202 ON READER SERVICE CARD

NORTH STAR

USERS

'IB' BOOKKEEPING

- General Ledger
- Accounts Payable
- Accounts Receivable
- Payroll

At last a really good sophisticated, Integrated Bookkeeping System. Developed & enhanced to be used by a very wide selection of businesses and professions.

'IB' was developed for the person who has limited knowledge of Computers and Bookkeeping.

We found there was a Bookkeeping need and 'IB' fills it.

- Easy To Learn
- Very Powerful
- Many reports
- Written in Basic
- Auto merge into General Ledger.
- Auto Start-Complete Error Trapping.
- Detailed Description Available.
- HORIZON or ADVANTAGE-DOS or CP/M HD or FLOPPY.

'IB' is a super value as many of its features are found in only the most expensive programs. DOS Version-\$500

POWER'S COMPUTERS
12491 SAN PABLO AVENUE
RICHMOND, CA. 94805
(415) 234-5412

CIRCLE 71 ON READER SERVICE CARD

ADVERTISERS INDEX

Reader Service	Advertiser	Page	Reader Service	Advertiser	Page	Reader Service	Advertiser	Page
98	ALCOR	129	27	Farbware	141	34	Performics, Inc.	113
3	A/N Software, Inc.	136				54	Phact Associates Ltd	27
7	Adcom Systems	137		GMR	43	70	Pickles & Trout	99
8	Advanced Computer Technology	1	24	Graphics Development Laboratories	3	175	Pion, Inc.	35
148	Advanced Digital Corp.	9	39	Great Salt Lake Computer Co., Inc.	81	77	Plum Hall	29
2	American Planning Corp.	20	40	Green Mountain Radio Research Co.	127	71	Power's Computers	144
199	Andra Tech	141				186	Pragmatic Designs, Inc.	33
5	Andreasen's Electronics Research & Development, Inc.	95	45	HSC, Inc.	126	72	Programmer's Shop	68
13	Ashton-Tate	45	25	Hawkeye Grafix	139	73	Programming International	16, 17
200	Automated Control Systems	120	95	Hayden Book Company	91	256	ProTools	141
201	Avocet Systems, Inc.	75	52	Heritage Software, Inc.	10			
				Honor System Software	10	196	Quic-N-Easi Products, Inc.	138
1	BC Systems	128	49	Integrand	110	93	R&L Micro Consulting Service	132
202	BD Software	144	185	Intercontinental Microsystems Corp.	C3	190	RR Software	12
150	Bay Technical Associates, Inc.	132	43	International Software Alliance	140			
151	Biat Research & Development Corp.	126				53	SLR Systems	138
17	Borland International	11	94	JRT Sysms, Inc.	79	42	SRX Systems	139
6	Carousel Microtools, Inc.	95	28	JVB Electronics	126	75	SWP, Inc.	26
9	Chromod Associates	132	29	Jade Computer Products	38, 39	20	Sanyo Business Systems Corp.	91
64	Code Works	93	30	KADAK Products Ltd	29	21	Sanyo Business Systems Corp.	95
167	Colorado Online	15	240	Key Microsystems, Inc.	127	47	Sanyo Business Systems Corp.	99
10	Communications Research Corp.	28		Knowledge	27	55	Schrenk Electronics/Mega Co.	123
51	Complexx Systems, Inc.	72, 73	242	Konan	53	58	Smith Systems, Inc.	139
226	Components Express, Inc.	23				50	SoftCraft	107
207	Compu-Draw	120	36	LA Software	141	16	Solution Technology, Inc.	123
12	CompuPro	C4	26	Laboratory Microsystems	77	60	Solution Technology, Inc.	125
90	Computer Component Distributors	55	37	Langley-St. Clair Instrumentation Systems, Inc.	137	78	Steele & Associates	123
84	Computer Design Labs	83		Lark Software	141	65	Suntronics Co., Inc.	121
62	Computer House	93	15	Logical Devices, Inc.	109	67	Symbolic Systems	136
209	Computer Innovations, Inc.	137	191	Loki Engineering, Inc.	59	223	Systems Group	105
14	Computing!	19	61			269	Tarbell Electronics	87
35	CompuView Products, Inc.	47				271	Telecon Systems	69
18	Connecticut microComputer, Inc.	123	69	MATCO, Inc.	104	220	Teletext Inc.	123
			44	MCP Computer Products	8	174	Teletek	4
66	D & W Digital	22	46	Macrotech International Corp.	C2	80	Teletek	89
215	Data Access Corp.	34	244	Magnolia Microsystems	141	80	Thoughtware, Inc.	6
92	Data Base Administrators, Inc.	132	245	Manx Software Systems	15	272	Total Access Systems	98
91	Data Sources	131	87	Mark Williams Company	25	83	2500 AD	103
96	Davidge Corp.	112	85	Micro Design Associates, Inc.	85	74	Two Bits Computer Products	109
89	Dedicated Micro Systems, Inc.	110	157	MicroType	110			
216	Delphic Systems	134	99	Mom's Computing	104	274	Unified Software Systems	133
33	Digital Graphic Systems, Inc.	93	183	Morrow	7	79	UniPress Software, Inc.	27
31	Digital Media	14	32	Mountain Micro Systems, Inc.	132	4	United Computer Corporation	67
63	Digital Research	68	38	MuSYS Corp.	2	82	United Controls	134
23	Disco-Tech	127	171	Mycroft Labs, Inc.	112			
						81	Voice Operated Computer Systems	136
219	Easi Software, Inc.	139	19	New Generation Systems, Inc.	31	177	Wave Mate, Inc.	113
154	Ecosoft, Inc.	109	11	North Star Computers, Inc.	51	59	Westerly Business Systems	99
57	Electralogics, Inc.	111				88	Whitesmiths, Ltd.	21
56	Electronic Control Technology, Inc.	121	100	Omni Data Products	140	278	Workman & Associates	133
97	Ellis Computing	117	68	ONETCO	128	86	Writers Digest Books	141
—	Empirical Research Group, Inc.	57	188	Optronics Technology	22			
				Owens, J.D. Associates Ltd	125			

Four Answers To Your S-100 Multi-User Problems.

Intercontinental Micro Systems makes everything you need for S-100 bus multi-user systems, networks or single user systems.

At a price that won't break your budget.

Quite simply, our single board computers, slaves, 256K memories and personality boards let you build a system now, not later. The hardware works, the software works,

and the prices are what you'd expect from a company that uses the most advanced

design, software and production techniques to keep costs down.

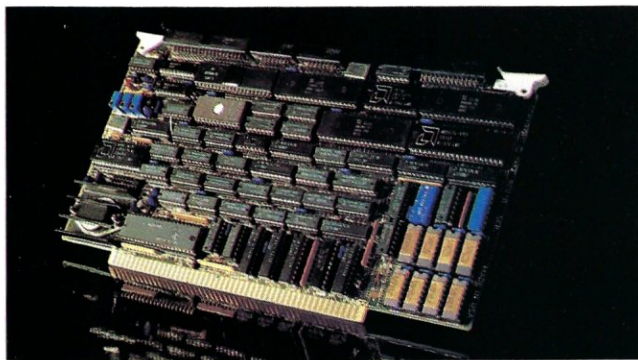
What you won't expect is the almost awesome sophistication of Intercontinental Micro System's products.

So stop messing around with multiple sourc-

ing, hardware integration problems and software nightmares. Come to Intercontinental

Micro and get it all — price, performance and delivery.

Read the specs, then call, write or circle the bingo number below. We'd be glad to send more information and help solve your S-100, multi-user system problems.

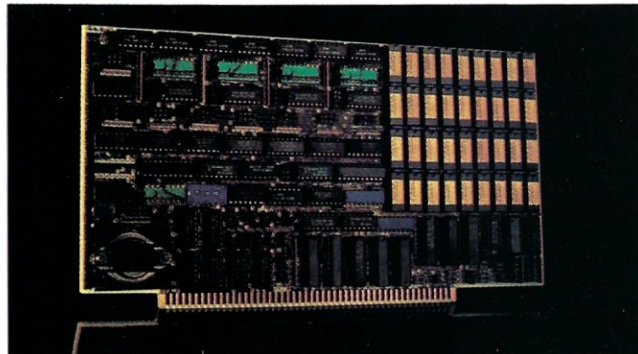
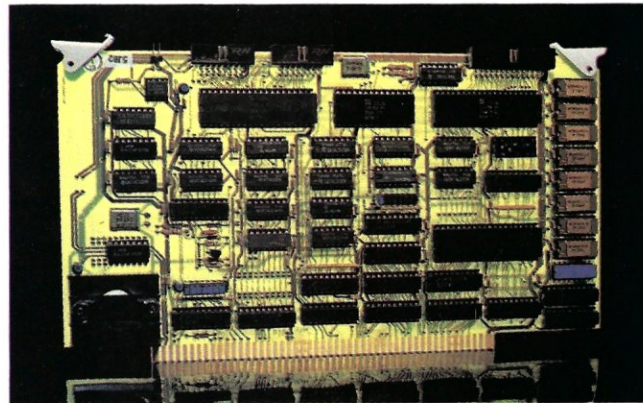


1 CPZ-48000 SINGLE BOARD COMPUTER.

□ IEEE 696.1/D2 S-100 compliance. □ Z80A™ 4MHz Operation. □ Floppy disk controller (FDC). Single or double sided. Single or double density. 8" or 5 1/4". □ Two synchronous or asynchronous serial I/O channels (SIO). □ Two parallel I/O channels (PIO). □ Four channel DMA controller. □ 64K on board RAM. □ Memory management unit (MMU). Addresses up to 16 megabytes of system memory. □ Eight Vectored priority interrupts. □ Provisions for 2K or 4K onboard EPROM. □ Software selectable baud rates. □ IBM Bisync, HDLC, SDLC and other protocols. □ CP/M, MP/M, and TurboDOS™ operating systems available. □ Turbo-Disk™ implementation included.

2 CPX-MX SLAVES.

□ IEEE 696.1/D2 S-100 compliance. □ Compatible with CPZ-48000 SBCP any Z-80A based CPU with extended address capability or 16 bit based CPUs complying with IEEE 696.1/D2 bus specification. □ Z-80B™ 6MHz (CPS-6X) or Z80A 4MHz (CPS-4X) operation. □ Two synchronous (CPS-MS) or asynchronous (CPS-MA) serial I/O ports. □ TurboDOS™ & CP/NET™ compatible. □ Master confiscation of slave memory for diagnostic purposes. □ Two parallel I/O ports; eight data bits + 2 handshake lines per port. □ 64 Kbytes of onboard dynamic RAM. □ Master/slave memory-to-memory transfers under DMA control @ 571 Kbyte/sec transfer rate when used with CPZ-48000 SBCP. □ Software selectable baud rates. □ Usable as an intelligent I/O processor in single user system.

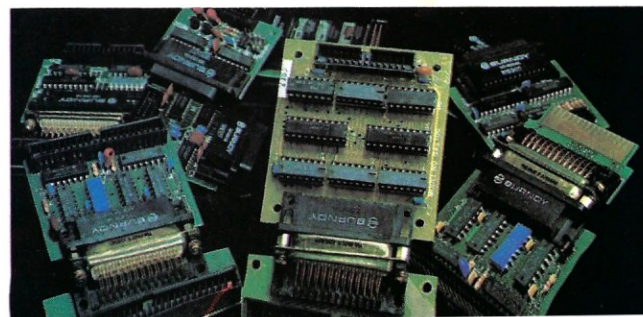


3 256KMB-100 256K MEMORY.

□ IEEE S-100 bus, spec 696.1/D2 compliance. The 256KMB-100 is compatible with most IEEE S-100 board products now on the market. □ Linear addressable to 2 megabytes. □ 225 nano-second access time, maximum, 160 nano-seconds, typical. □ 295 nano-second read-write time, minimum. □ Bank selectable 16K increments. □ I/O port address bank selection. □ Configures for phantom deselection. □ Parity error detection, visual and/or interrupts. □ Bank selection compatible with CROMIX™, CP/M2.2™, MP/M, Alpha Micro, and other major systems.

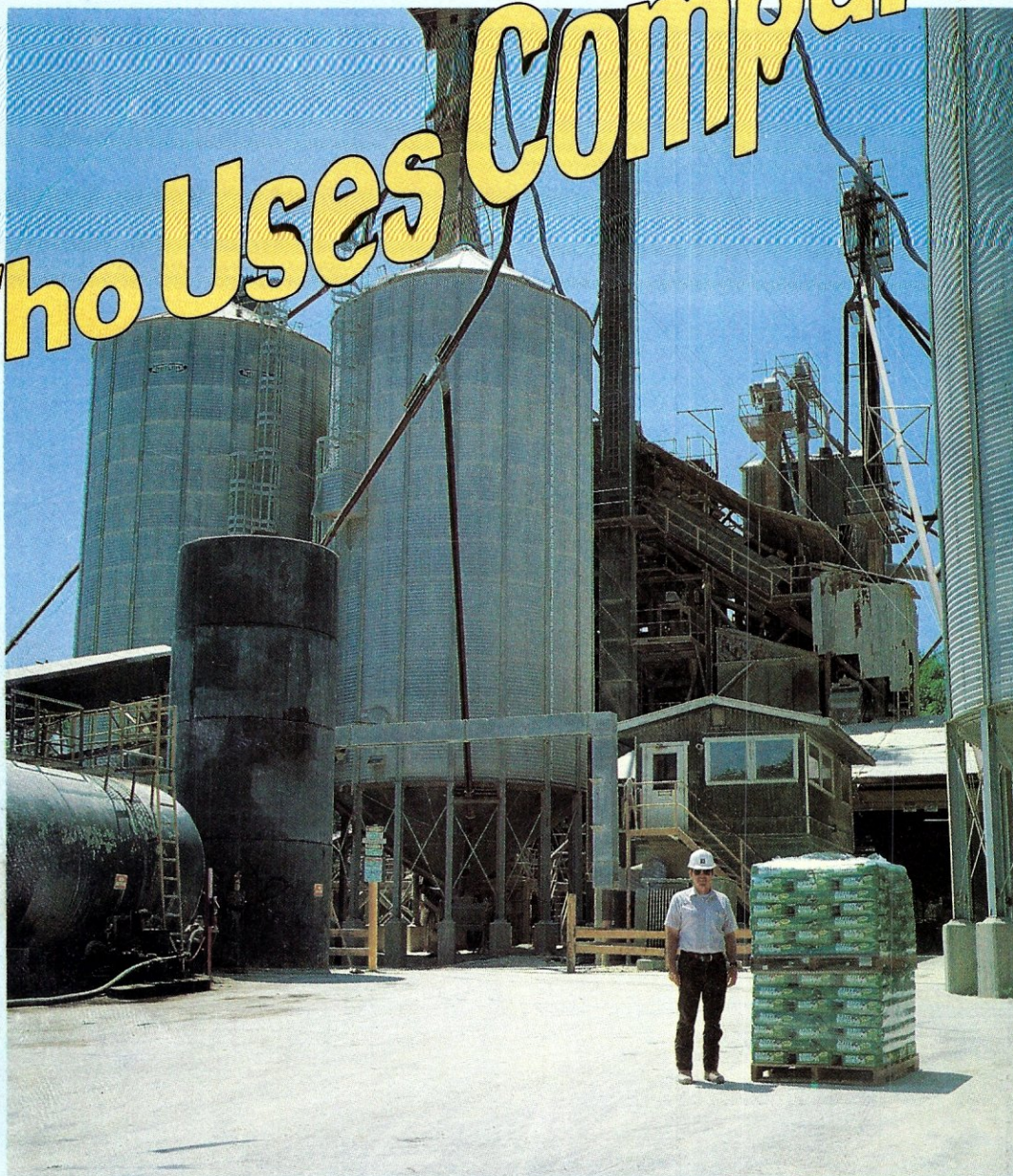
4 PERSONALITY BOARDS.

□ Centronics printer. □ 8 inch floppy disk. □ 5 1/4 inch floppy disk. □ RS232 serial communications. □ Synchronous/asynchronous modem. □ Priam smart/smart E hard disk. □ Long distance serial communication (2000 ft @ 9600 baud). □ Shugart Associates Systems Interface (SASI). □ Clock/calendar. □ Konan David, Jr.™ hard disk. □ Archive tape drive.



4015 Leaverton Court
Anaheim, CA 92807

Who Uses CompuPro?



Although it owns a large minicomputer, Mid-Florida Mining Company is turning more and more frequently to its microcomputer—made by **CompuPro**.

"It's more flexible," explains Allen Edgar, president of the tri-state operation that turns a unique absorbent clay into a broad line of products ranging from cat litter to jet fuel filtrate.

The problem with the mini, according to chief financial officer Michael Wilkinson, is that modifying its programs requires expensive and time-consuming outside programming. By contrast, the firm is adding new applications to the **CompuPro** so fast that in one year it has taken on inventory control, production scheduling, sales figures, invoicing, customer lists and even executive flight planning.

In clay mines and board rooms, **CompuPro** delivers performance, quality and reliability. For your business, scientific and industrial computing solutions, contact a **Full Service CompuPro System Center** today; call (415) 786-0909, ext. 206 for location.

Mid-Florida Mining Company's **CompuPro** system was integrated by Micro Computer Technology of Brandon, Fla., a **Full Service CompuPro System Center**.

CIRCLE 12 ON READER SERVICE CARD

CompuPro